REVISED FINAL FOCUSED REMEDIAL INVESTIGATION REPORT

Salt River Project's

16th Street Facility

Phoenix, Arizona

Submitted to:

United States Environmental Protection Agency

Submitted by:

AMEC Geomatrix, Inc., Scottsdale, Arizona

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Project 10108.000.1

AMEC Geomatrix

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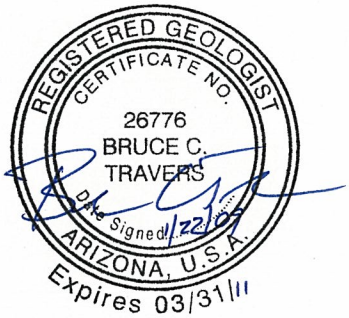

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

% – percent
-- – not applicable
?? – not established
+ – positive
< – less than, analyte not detected at concentration greater than the reporting limit
> – greater than
-1.0 – negative value
°F – Degrees Fahrenheit
(atm-m^3)/(mol) – atmosphere-cubic meter per mole
(g-oc)/(g-s) – gram organic carbon per gram soil
(kg-s)/(L-s) – kilogram soil per liter soil
(L/m^3) – liter per cubic meter
(L-a)/(L-s) – liter air per liter soil
(L-w)/(kg-s) – liter water per kilogram soil
(L-w)/(L-a) – liter water per liter air
(L-w)/(L-s) – liter water per liter soil
(mL-w)/(g-oc) – millimeter water per gram organic carbon
1,1,1-TCA – 1,1,1-Trichloroethane
1,1,2-TCA – 1,1,2-Trichloroethane
1,1-DCA – 1,1-Dichloroethane
1,1-DCE – 1,1-Dichloroethene
1,2,4-TCB – 1,2,4-Trichlorobenzene
1,2,4-TMB - 1,2,4-Trimethylbenzene
1,2-DCA – 1,2-Dichloroethane
1,2-DCB – 1,2-Dichlorobenzene
1,3-DCB – 1,3-Dichlorobenzene
1,4-DCB – 1,4-Dichlorobenzene
ACGIH – American Conference of Governmental Industrial Hygienist
ADEQ – Arizona Department of Environmental Quality
ADHS – Arizona Department of Health Services
ADWR No. – Arizona Department of Water Resources Number
AEL – Aerotech Environmental Laboratories
AIHA – American Industrial Hygiene Association
AMEC Geomatrix – AMEC Geomatrix, Inc.
AOC – Administrative Order on Consent
ARARs – applicable, or relevant and appropriate requirements
ASG – Active Soil Gas Boring
ASM – Arizona State Museum
ASTM – American Society of Testing and Materials
ASTs – Aboveground Storage Tanks
AZGFD – Arizona Game and Fish Department
BASG – Background Active Soil Gas Boring
bgs – below ground surface
bmp – below measuring point
BTEX – Benzene, Toluene, Ethylbenzene, and Total Xylenes
C – Ceiling Limit
CA – Chloroethane
CAG – Community Advisory Group

Cal-EPA – California Environmental Protection Agency
CAS – Columbia Analytical Services
CB – Chlorobenzene
CE – Chloroethene
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
$CHCl_3$ – Chloroform
cis-1,2-DCE – cis-1,2-Dichloroethene
CIH – Certified Industrial Hygienist
CL – Lean Clay
COCs – Contaminants of Concern
CSM – Conceptual Site Model
Cs – Predicted Concentration in Soil
Csg – Soil Vapor Concentration
DI – Deionized
DTSC – Department of Toxic Substance Control
E – East direction
EB – Ethylbenzene
EC – Ethyl Chloride
ED – Effective Date
EPA – Environmental Protection Agency
ePTFE – polytetrafluoroethylene
ERA – Ecological Risk Assessment
eV – electron volt
EVAP – Evaporative Cooling System
FSP – Field Sampling Plan
ft/day – feet per day
ft/ft – feet/foot
ft/yr – feet per year
ft^2 – square foot
ft^3 – cubic foot
ft^3/L – cubic foot per liter
g/cm^3 – grams per cubic centimeter
g/ft^2-yr – gram per square feet per year
GC/MS – Gas Chromatography/Mass Spectrometry
Geomatrix – Geomatrix Consultants, Inc.
GPLs – Groundwater Protection Levels
GW – Groundwater
H' – Henry's Law constant
HASP – Health and Safety Plan
HHRA – Human Health Risk Assessment
HVAC – Heating, Ventilation, and Air Conditioning
IAQ – Indoor Air Quality
in/yr – inches per year
ID – Identification
IDW - Investigation Derived Wastes
J – Analyte detected, reported concentration is an estimate
J&E – Johnson and Ettinger
JET – Johnson Environmental Technologies
K_{oc} – Organic Carbon Distribution Coefficient
LAU – Lower Alluvial Unit

lbs/ft^3 – pounds per cubic foot
LUST – Leaking Underground Storage Tank
m^2/d – square meters per day
mg – milligram
µg – microgram
µg/g – micrograms per gram
µg/L – micrograms per liter
µg/m^3 – micrograms per cubic meter
mg/L – milligrams per liter
mg/m^3 – milligrams per cubic meter
mg/kg - milligram per kilogram
mL – milliliter
mL/g – milliliters per gram
mL/min – milliliters per minute
mm – millimeters
MAU – Middle Alluvial Unit
MCL – Maximum Contaminant Level
MDL – Method Detection Limit
ML – Silt
msl – mean sea level
N – North direction
na – not available
NA – not analyzed
NAPL – Non-Aqueous Phase Liquid
ND – Non-Detect
NPL – National Priorities List
NR-SRLs – non-residential soil remediation levels
NW – Northwest direction
o- – ortho
OSHA – Occupational Safety and Health Administration
OU1 – Operable Unit 1
OU2 – Operable Unit 2
OU3 – Operable Unit 3
OUs – Operable Units
p- – para
PCB – Polychlorinated Biphenyl
PCE – Tetrachloroethene
PELs – Permissible Exposure Levels
PID – Photoionization Detector
ppbv – parts per billion by volume
ppm – parts per million
ppmv – part per million by volume
PRPs – Potential Responsible Parties
PSA – Potential Source Area
PTFE – Polytetrafluoroethylene
QAPP – Quality Assurance Project Plan
R – Rejected
RAOs – Remedial Action Objectives
RCRA – Resource Conservation and Recovery Act
RI – Remedial Investigation

RI/FS – Remedial Investigation, Feasibility Study
R-SRLs – Residential soil remediation levels
S – South direction
SAP – Sampling and Analysis Plan
SE – Southeast direction
Shaw – Shaw Environmental Inc.
SIM – selective ion monitoring
SP – Poorly Graded Sand with Gravel
SRP – Salt River Project
SRV – Salt River Valley
Sump SSG-15I – sewer interceptor grease trap SSG-15I
SVMW – Soil Vapor Monitor Well
SW – Southwest direction
TCE – Trichloroethene
TCLP – Toxicity Characteristic Leaching Procedure
TIC – Tentatively Identified Compound
TLVs – Threshold Limit Value
TOC – Total Organic Carbon
TPH – Total Petroleum Hydrocarbons
TPHC – Total Petroleum Hydrocarbon
trans-1,2-DCE – trans-1,2-Dichloroethene
Transwest – Transwest Geochem, Inc.
TVHC – Total Volatile Hydrocarbon
UAU – Upper Alluvial Unit
USCB – United States Census Bureau
UST – Underground Storage Tank
UJ – Analyte was not detected above the reported sample quantitation limit, which is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
VC – Vinyl Chloride
VCR – Vapor Collection Receptacle
VDC – Vinylidene Chloride
VOCs – Volatile Organic Compounds
W – West direction
WEELs – Workplace Environmental Exposure Levels
WQARF – Water Quality Assurance Revolving Fund

EXECUTIVE SUMMARY

Under the terms of the Administrative Order on Consent (AOC) for the Focused Remedial Investigation and Feasibility Study (RI/FS) (U.S. Environmental Protection Agency [EPA], 2004a), the Salt River Project (SRP) performed a Focused RI at SRP's 16th Street Facility (Site). The Site, which is located at 1616 East Lincoln Street, in Phoenix, Arizona is within the Motorola 52nd Street Superfund Site Operable Unit 3 (OU3) study area. The purpose of the investigation was to determine if the Site is or has been a source of groundwater or soil contamination associated with the Motorola 52nd Street Superfund Site. The Focused RI included: 1) investigation of the nature and extent of potential contamination from the 12 identified Contaminants of Concern (COCs) in air, soil, and groundwater; 2) identification of risks to human health and/or the environment due to the releases or the threat of releases of the COCs; and 3) evaluation of the need for remedial action.

Numerous operations and activities have been conducted at the Site from 1921 to the present. The principle activities at the Site included warehousing, storage of electrical equipment, storage of aquatic weed control chemicals, vehicle service and repair, meter and radio repair, electrical construction and maintenance support, and material salvage and reclamation (SRP, 2004). The Site also previously included a chemistry lab, a print shop, a hydrographic shop, a central line dispatch office, and a carpentry shop. During the 1960s until the mid 1970s, SRP used bulk liquid (55-gallon containers) of 1,1,1-trichloroethane (1,1,1-TCA) or SS-25, a product containing tetrachloroethene (PCE) in the Transportation Garage, the Repair Garage, the Heavy Duty Garage, the Paint and Body Shop, and the Electric Shop (SRP, 2004).

In September 2005, SRP submitted the *Focused Remedial Investigation and Feasibility Study Work Plan* (Geomatrix, 2005b). The first phase of the investigation included both passive and active soil gas sampling. The purpose of the first phase using the passive soil gas samplers (GORE-SORBER™ modules) was to screen for the presence of COCs in various potential source areas (PSAs). The purpose of the active soil gas sampling was to evaluate potential release of COCs below the base of the sumps/interceptors and drywell/drywell clusters. The passive soil gas results indicated that minor releases of PCE may have occurred at the potential source areas, PSA-1 and PSA-3. The passive soil gas data indicated that COCs were not present in the remaining PSAs.

Based on the active soil gas analytical results, a 1 microgram per liter (µg/L) (1,000 microgram per cubic meter [$\mu g/m^3$]) contour was developed near sewer interceptor grease trap SSG-16I (sump SSG-16I) and/or drywells DW-3A/3B; sewer interceptor grease trap SSG-15I (sump SSG-15I); drywells DW-2B/2D, and drywell DW-4 (southwest portion of the Site). This contour

represented the area of further investigation. Based on review of the active and passive soil gas sampling results and discussions with EPA, Arizona Department of Environmental Quality (ADEQ), and SRP, the locations of the two soil vapor monitor wells (SVMWs) were established. Two multiport SVMWs were installed at the locations where the greatest PCE concentrations in the active soil gas sample were detected.

SRP used the VLEACH (Ravi and Johnson, 1997) and Summer's (EPA, 1996) models to estimate the current potential impact of Site COCs to groundwater. PCE and trichloroethene (TCE) were the only Site COCs detected in the SVMW soil vapor samples collected during three separate sampling events. SRP used the soil vapor data collected during the three sampling events to evaluate the potential migration of only PCE to groundwater, since TCE was detected at a fraction of the PCE concentrations (up to 100 times lower). Soil sampling was conducted in June 2008 to provide additional data for calibrating the groundwater model. To evaluate if the Site has been a source to groundwater contamination associated with Site COCs, SRP conducted historical groundwater impact modeling using an approach similar to the one applied at other facilities within the OU3 study area. To estimate possible historical groundwater impact, two stages of modeling were performed. The purpose of the Stage 1 modeling was to estimate theoretical historical soil concentrations based on the time periods that chlorinated solvents, specifically PCE, were used on Site. Historical soil concentrations were calibrated based on the results from previous soil gas sampling and soil sampling conducted as part of the Phase II Remedial Investigation activities. The VLEACH model, which was used in the Stage 2 modeling, applied the source terms from the Stage 1 modeling to calculate the PCE flux to groundwater for the two potential sources, the drywell and the sump SSG-16I. The calculated flux rates for the Stage 2 VLEACH modeling were used as input to a concatenation file to determine the cumulative mass flux over the PCE usage time period. The modeled groundwater concentrations of PCE ranged between 8×10^{-5} to 0.004 µg/L. The modeled groundwater concentrations based on the estimated historical impact are more than three orders of magnitude below the federal Maximum Contamination Level (MCL) for PCE of 5 µg/L. The results of the Phase II groundwater modeling demonstrate that the historic potential for adverse groundwater impacts in excess of drinking water standards is very low based on the calibrated potential source concentrations of PCE. The fate and transport modeling results indicate that the detected PCE concentrations in the subsurface do not pose an unacceptable risk to drinking water.

Additional modeling was requested by EPA in their comment letters dated November 25, and December 12, 2008. AMEC Geomatrix performed the additional groundwater modeling scenarios as requested by EPA. The results of the additional groundwater modeling showed that the potential impact of PCE to groundwater was below the federal MCL for PCE of 5 µg/L.

In addition to evaluating the subsurface environment at the Site, SRP also conducted indoor air monitoring in the summer and winter seasons of 2006. All of the chemicals detected were significantly below the worker exposure criteria, which included the Occupational Safety and Health Administration's (OSHA) Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs). None of the chemicals detected in the indoor air samples were listed on the American Industrial Hygiene Associations' (AIHA) Workplace Environmental Exposure Levels (WEELs).

The Johnson and Ettinger (J&E) model (Johnson and Ettinger, 1991) was used to evaluate the potential exposure to vapor intrusion by Site COCs measured in soil gas. Two data sets were evaluated: 1) soil gas data excluding samples that were originally rejected based on elevated concentrations of the leak detection compound and 2) all soil gas data. The overall potential lifetime excess cancer risk based on the maximum concentrations in soil gas for either data set was 8.8×10^{-6} using U.S. EPA toxicity criteria for PCE and TCE and 6.0×10^{-6} using California Environmental Protection Agency (Cal-EPA) toxicity criteria for PCE and TCE; these results are within acceptable carcinogenic risk range of 1×10^{-6} to 1×10^{-4} (EPA, 1990a and 1990b). The potential hazard index based on the maximum concentrations in soil gas was 1.8 for the data set excluding the originally rejected values using both EPA and Cal-EPA toxicity criteria. When the data set includes the two flagged data points, the potential hazard index is 36. It should be noted that hazard indices greater than 1 do not necessarily mean that adverse health effects will be observed. The potential hazard indices, which are greater than the acceptable hazard index of one, resulted from concentrations of 1,2,4-trichlorobenzene (1,2,4-TCB). The highest concentrations of 1,2,4-TCB in soil gas were 900 μg/L (900,000 $\mu g/m^3$) and 44 μg/L (44,000 $\mu g/m^3$) in two active soil gas locations. The next highest concentration in soil gas was 2.3 μg/L (2,300 $\mu g/m^3$), which corresponds to a hazard quotient of 0.09. All other detections of 1,2,4-TCB in soil gas were substantially lower and, therefore, would result in a hazard index significantly less than 1. Also, 1,2,4-TCB was not detected in indoor air samples. Thus, the 1,2,4-TCB detected in soil gas is not considered to present an issue in indoor air. The individual hazard quotients and cumulative hazard index for all other chemicals were less than 1, which would indicate that the noncancer health effects from exposure to these chemicals is not likely.

SRP also removed sump SSG-15I and performed soil sampling beneath and around the four walls of the sump. The results of soil samples collected during the removal of the sump were all below the Method Detection Limit (MDL) (500 micrograms per kilogram [μg/kg] or less) for the Site COCs. In addition, all of the soil sample results for PCE were below the MDL of 50 μg/kg or less. The MDLs were below the Groundwater Protection Levels (GPL), established by the ADEQ for those compounds that have an established GPL.

Based on the evaluation of the preliminary remedial action objectives (RAOs) for the Site, the Site does not represent a threat to human health and/or the environment based on Site COCs present in soil gas or indoor air samples. Therefore, it is not technically justified for SRP to install a nested groundwater monitor well, perform semi-annual groundwater monitoring of the four monitor wells at or near the Site (16ST-01, 16ST-02, 16ST-03 and 16ST-04), or perform further remedial actions at the Site. Additionally, it is not necessary to perform a feasibility study for the Site.

1.0 INTRODUCTION

AMEC Geomatrix, Inc. (AMEC Geomatrix), on behalf of the Salt River Project (SRP), has prepared this Revised Focused Remedial Investigation (RI) Report for SRP's 16th Street Facility (Report). The SRP's 16th Street Facility (Site) is located at 1616 East Lincoln Street in Phoenix, Arizona, and is within the Operable Unit 3 (OU3) study area of the Motorola 52nd Street Superfund Site (Figure 1). The Motorola 52nd Street Superfund Site was placed on the National Priorities List (NPL) in 1989 and has been identified as a source of groundwater contamination by volatile organic compounds (VOCs), primarily trichloroethene (TCE). The United States Environmental Protection Agency (EPA) and the Arizona Department of Environmental Quality (ADEQ) are the regulatory agencies overseeing the investigation and remediation of the Motorola 52nd Street Superfund OU3 Site.

1.1 PURPOSE AND SCOPE

The investigation activities presented in this Report were performed to determine if the Site is or has been a source of groundwater or soil contamination associated with the Motorola 52nd Street Superfund Site OU3 and, if necessary, to establish the appropriate steps to mitigate identified source(s) remaining at the Site. Additionally, the RI provides information to assess the risks to human health and the environment. Contaminants of Concern (COCs) were identified in the *Administrative Order on Consent* (*AOC) for Remedial Investigation/Feasibility Study (RI/FS)* Docket No. 2004-19 (EPA, 2004a) between SRP and EPA. The effective date (ED) of the AOC was June 2, 2004. COCs, which were identified for the Site in the AOC (EPA, 2004a), include the following compounds:

- chloroethane (CA)/ethyl chloride (EC)
- 1,1-dichloroethane (1,1-DCA)
- 1,2-dichloroethane (1,2-DCA)
- 1,1-dichloroethene (1,1-DCE)/vinylidene chloride (VDC)
- cis-1,2-diichloroethene (cis-1,2-DCE)
- trans-1,2-dichloroethene (trans-1,2-DCE)

- tetrachloroethene (PCE)
- 1,1,1-trichloroethane (1,1,1-TCA)
- 1,1,2-trichloroethane (1,1,2-TCA)
- TCE
- vinyl chloride (VC)/chloroethene (CE)
- 1,4-dioxane

1.2 PROJECT HISTORY

Based on the information available from the ADEQ Website (ADEQ, 2006), the Motorola 52nd Street Superfund Site is divided into three Operable Units (OUs): Operable Unit 1 (OU1), 2 (OU2), and OU3; and the Honeywell 34th Street Facility (Figure 1). The boundaries of OU1 study area extend from 52nd Street to the east, Palm Lane to the north, Roosevelt Street to the south, and 46th Street to the west. The approximate OU2 study area extends from Roosevelt Street to the north, 46th Street to the east, Buckeye Road to the south, and 18th Street to the west. Within OU2, the approximate boundaries of the Honeywell facility extend from 36th Street to the east, 29th Street to the west, and is immediately north of the Sky Harbor International Airport north runway. The approximate OU3 study area boundaries are McDowell Road to the north, 20th Street to the east, Buckeye Road to the south, and 7th Avenue to the west.

The following information presents a short historical summary of OU3 as presented in the ADEQ Website (ADEQ, 2006) and Shaw Environmental Inc.'s (Shaw) *Final Groundwater Investigation Report Phase I and II Well Installation, Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix, Arizona* (Shaw, 2005):

- OU3 was formerly part of the ADEQ East Washington Water Quality Assurance Revolving Fund (WQARF) site, which was listed on the WQARF Priority List in 1987. In 1997, the East Washington WQARF site was not re-listed on the new WQARF Registry.
- On November 26, 1997, EPA sent a letter to ADEQ creating a third operable unit – OU3, which included the OU3 study area boundaries.
- After conducting EPA's own modeling study, EPA sent a letter to ADEQ on February 25, 2000, which concluded that the down gradient boundary (7th Avenue) for the study area was appropriate. EPA also concluded that Motorola's releases are not likely to have migrated westward beyond 7th Avenue based on the available information to date.

- To assess the possibility of contaminants from Motorola and Honeywell source areas migrating beyond OU2, EPA completed a groundwater flow and transport model for the area in June 2000.

- EPA completed *Final Groundwater Investigation Work Plan, Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix, Arizona* dated December 3, 2001 (IT, 2001).

- In spring 2002, EPA installed 15 groundwater monitor wells to investigate the nature and extent of groundwater contamination in the OU3 study area. EPA installed monitor wells in clusters of up to three wells to define the vertical extent of groundwater contamination.

- In January 2003, EPA completed the *Work Plan Supplement to the Final Groundwater Investigation Work Plan for Proposed Phase II* (IT, 2003). The supplement to the work plan included installation of additional monitor wells that were needed to complete the groundwater investigation for the OU3 study area.

- The EPA completed the installation of 12 additional monitor wells in the OU3 study area to further define the nature and extent of groundwater contamination. Monitor wells in clusters of up to four were installed at the following locations: 1) Fillmore and 5th Street; 2) McKinley and 5th Street; 3) Washington and 6th Avenue; 4) Buchanan and 1st Street; 5) Washington and 16th Street; 6) Fillmore and 15th Street; and 7) Garfield and 16th Street.

- In 2003, EPA initiated negotiations with Potential Responsible Parties (PRPs) for investigations of the soil and groundwater conditions at the facilities. PRPs were sent a General Notice Letter.

- The *Final Groundwater Investigation Report* (Shaw, 2005) summarizes the findings of the Phase I and Phase II groundwater investigation in the OU3 study area.

- The *Groundwater Monitoring Report for Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix, Arizona March 2008* dated July 31, 2008 (Shaw, 2008) for the well network in the OU3 study area was submitted.

The Site was initially identified by ADEQ in October 1988 as a potential source of groundwater contamination in the Eastlake Park area. A chronology of events for the Site is presented in Table 1. Several additional investigative activities have been conducted at the Site. A more detailed discussion of these activities is presented in *Section 3.0* of this Report.

1.3 PROJECT OBJECTIVES

Pursuant to the AOC (EPA, 2004a), SRP prepared *Final Technical Memorandum Summarizing Remedial Action Objectives for the 16th Street Remedial Investigation/Feasibility Study, Salt River Project's 16th Street Facility, Phoenix, Arizona* (Technical Memorandum) dated April 28, 2005 (Geomatrix, 2005a). The purpose of the aforementioned Technical Memorandum was to summarize Remedial Action Objectives (RAOs) for the protection of human health and the environment, outline applicable or relevant and appropriate requirements (ARARs), and provides a range of potential RAOs, including presumptive remedies. On July 21, 2005, EPA approved the Technical Memorandum (EPA, 2005a).

Prior to initiating the RI/FS activities, AMEC Geomatrix prepared a *Focused Remedial Investigation and Feasibility Study Work Plan, Salt River Project's 16th Street Facility, Phoenix, Arizona* (RI/FS Work Plan) dated September 26, 2005 (Geomatrix, 2005b), which provided the investigative objectives, rationale, and procedures to be followed at the Site. The RI/FS Work Plan was prepared in accordance with the relevant sections of the EPA document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*, U.S. EPA, Office of Emergency and Remedial Response, October 1988 (RI/FS Guidance) (EPA, 1988), and other guidance documents that are relevant to conducting a focused RI/FS. The RI/FS Guidance presents presumptive remedy guidance for characterizing and selecting remedies at sites with VOCs in soils and/or groundwater.

As part of the pre-field activities, AMEC Geomatrix also prepared a *Sampling and Analysis Plan, Salt River Project's 16th Street Facility, Phoenix, Arizona* (SAP) (Geomatrix, 2005c), which included a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). AMEC Geomatrix also prepared a *Health and Safety Plan, Salt River Project's 16th Street Facility, Phoenix, Arizona* (HASP) (Geomatrix, 2005d), which provided health and safety information for Site related activities. The aforementioned documents comprise the Project Plans for the field activities. The RI/FS Work Plan and the Project Plans were approved by the EPA on October 21, 2005 (EPA, 2005b). The purpose of the RI field activities was to characterize potential impacts of COCs to soil and/or groundwater and, if necessary, to mitigate COCs source(s) remaining at the Site.

The objectives of the RI included the following:

- Conduct passive soil gas survey in the Potential Source Areas (PSAs) of concern;

- Conduct active soil gas sampling beneath the base of tne sumps/interceptors and drywell/drywell clusters and conduct comparison active soil gas sampling at selected passive soil gas survey locations for comparison;
- Evaluate data with EPA and select soil vapor monitor well (SVMW) locations, as appropriate and evaluate the need to collect additional active soil gas samples to assess vapor intrusion pathways, if necessary;
- Install SVMWs, if necessary;
- Conduct three rounds of soil vapor sampling of the SVMWs; and,
- Continue monitoring of the four Site groundwater monitor wells.

1.4 REPORT ORGANIZATION

This Report is organized into the following sections:

- Section 1 – Introduction
- Section 2 – Site Background
- Section 3 – Study Area Investigation and Methods
- Section 4 – Physical Characteristics of the Study Area
- Section 5 – Nature and Extent of Contamination
- Section 6 – Data Validation
- Section 7 – Phase I Groundwater Impact Modeling
- Section 8 – Baseline Risk Assessment
- Section 9 – Community Involvement
- Section 10 – Conclusions and Recommendations
- Section 11 – References
- List of Appendices
  - Appendix A: Detail Calculations for the Johnson and Ettinger Model
  - Appendix B: Geotechnical Laboratory Report – Terracon Consultants, Inc.
  - Appendix C: Waste Analytical Report – Soil Vapor Monitor Well Installation
  - Appendix D: Waste Manifest – Soil Vapor Monitor Well Installation
  - Appendix E: Laboratory Analytical Data – Soil Boring Investigation June 2008
  - Appendix F: Data Validation/Verification Summary
  - Appendix G.1: Phase I Groundwater Modeling – VLEACH Files
  - Appendix G.2: Phase II Groundwater Modeling – Stage 1 VLEACH Files
  - Appendix G.3: Phase II Groundwater Modeling – Stage 2 VLEACH Files
  - Appendix H: Material Safety Data Sheet for SS-25
  - Appendix I.1: Groundwater Modeling Files for Spillage Scenarios
  - Appendix I.2: Groundwater Modeling Files for an Aquifer Thickness of 10 Feet
  - Appendix I.3: Groundwater Modeling Files for EPA Requested Parameters
  - Appendix J.1: November 2005 Active Soil Gas Data

- Appendix J.2: June 2006 Active Soil Gas Data
- Appendix J.3: April 2007 Soil Vapor Monitor Well Data
- Appendix J.4: May 2007 Soil Vapor Monitor Well Data
- Appendix J.5: June 2007 Soil Vapor Monitor Well Data

2.0 SITE BACKGROUND

Information included in the following section has been extracted from the report entitled *Salt River Project's 16th Street Facility – Research Report, Motorola 52nd Street Superfund Site, OU3 Study Area*, *Administrative Order on Consent Docket No. 2004-19* (Research Report) (SRP, 2004). The geology and hydrogeology information within the Motorola 52nd Street Superfund Site area described below was obtained from the Research Report (SRP, 2004) and includes information from the Reynolds and Bartlett report entitled *Subsurface Geology of the Easternmost Phoenix Basin, Arizona: Implications for Groundwater Flow* (Reynolds and Bartlett, 2002). The geologic and hydrogeologic data that have been collected thus far at the Site are also discussed.

2.1 PHYSICAL SETTING

The following section describes details about the facility setup, land use and demographics, climate, natural resources, ecology, cultural features, surface water, geology, and hydrogeology.

2.1.1 Facility Description

The Site is located on the northeast corner of Lincoln and 16th Streets in Phoenix, Arizona, within the NW ¼, NW ¼, SW ¼ of Section 10, Township 1 North, Range 3 East, Gila & Salt River Baseline and Meridian, Maricopa County. The street address for the Site is 1616 East Lincoln Street, Phoenix, Arizona 85034. Figure 1 provides a Site location map.

The Site is approximately 8.6 acres. The property is zoned A-1, Light Industrial, by the City of Phoenix. Presently, there are approximately 16 buildings or structures located at the Site (Figure 2). The buildings are located generally on the western half and northern boundary of the property. The majority of the structures are contiguous. The eastern half of the Site consists of vehicle and trailer parking and open equipment storage. A truck scale is located on the southeast corner of the property and an east to west trending rail spur is located on the northern property boundary. The Site is enclosed by a combination of chain-link, masonry fencing, and exterior building walls. Access to the Site is controlled by SRP security personnel.

Currently, the Site's ground surface is almost entirely paved with asphalt and/or concrete, or is covered by the above referenced buildings and structures. Unpaved

portions of the Site consist of landscaping on the south property boundary, and small strips of land on the southwest, northeast, and east-central portions of the Site. The ground surface at the Site is gently undulating, generally sloping toward storm water drainage features.

2.1.2 Land Use and Demographics

The Site is located in an urban area, approximately one and a half miles east-southeast of downtown Phoenix. Phoenix Sky Harbor International Airport is located approximately one mile east of the Site. Land adjacent to the Site consists of industrial properties, including a Union Pacific Railroad switchyard to the northwest.

Demographic information for the Site was obtained from the United States Census Bureau (USCB), 2000 Census. The population of the one square mile area (census tract 1139) encompassing the Site was 1,471 persons (USCB, 2000). A total of 382 households were identified in this area, with the majority of these homes located approximately one-quarter to one-half mile north and northeast of the Site (USCB, 2000).

2.1.3 Climate

The climate of the Phoenix area is semi-arid (Sellers et al., 1985). Precipitation averages between seven and nine inches per year (in/yr) with higher elevations receiving somewhat more (Sellers et al., 1985). Precipitation occurs primarily during the months of July through September, and December through March (Hammett and Herther, 1995). Most of the precipitation evaporates before becoming runoff (Hammett and Herther, 1995).

Hot summers and mild winters characterize this area (Sellers et al., 1985). Daytime high temperatures in July average between 100 degrees Fahrenheit (°F) and 110°F, while nighttime low temperatures in July average between 70°F and 80°F. Daytime high temperatures in January average between 65°F and 70°F, while low temperatures in January average between 35°F and 40°F.

2.1.4 Natural Resources

With the exception of groundwater, there are no viable natural resources at the Site. The potential future uses of groundwater may include drinking water, industrial, agricultural, and recreational uses. Currently, groundwater beneath the Site is not being utilized for any of the potential future uses.

2.1.5 Ecological Assessment

The Arizona Game and Fish Department (AZGFD) was contacted and asked to review the Heritage Data Management System for the presence of any special status species within a three-mile radius of the Site. The AZGFD reported that none were identified in the area (AZGFD, 2004). In addition, the Site is not located in the vicinity of any Designated or Proposed Critical Habitats (Hammett and Herther, 1995). SRP has conducted a physical inspection of the Site and has found no evidence of native flora or fauna at the Site or Waters of the United States, as defined under Section 404 of the Clean Water Act.

2.1.6 Cultural Features

The Site is immediately adjacent to a prehistoric site associated with the Hohokam culture (Greenwald et al., 1994). The prehistoric site is designated AZ T:12:62 Arizona State Museum (ASM) and named the Dutch Canal Ruin after a historic irrigation feature, Dutch Ditch, which was a major lateral of the Swilling Ditch, the first irrigation canal in the Phoenix area. Frank Midvale, a vocational archaeologist who recorded many of the prehistoric sites in the Phoenix Basin, originally recorded the prehistoric site in the mid-1930s. The site was in existence at this time and the prehistoric site boundary is interpreted as intersecting the southeast corner of the facility. This suggests that the prehistoric site could extend onto the facility.

The Dutch Canal Ruin is a series of features related to prehistoric agriculture: field houses, farmsteads, canals, and a later component composed of a year-round habitation area. The prehistoric site is located on the first terrace and floodplain of the Salt River and the southern boundary of the Site abuts Turney's Gully, a remnant erosional channel of the Salt River. The first terrace is the location of the earliest irrigation features in the portion of the Salt River. The fertile and easily removed soils allowed incipient agriculture. The earliest of the six canals was constructed in 600s A.D. The latter four canals date to 650-730 A.D. (two superimposed canals), 830-930 A.D. (one canal), and 1300-1450 A.D. (one canal). One canal was not assignable to any time period. The architectural features are equivalent in age to the canals.

The field houses and farmsteads are associated with canal operation and maintenance, crop planting, harvesting and care, and, probably, resource procurement from the nearby river environment. A field house is a small, informal structure used temporarily or seasonally, probably by one or two people. A farmstead is a cluster of field houses occupied by a larger group, possibly an extended family. These structures represent the agricultural component of a larger occupational complex. The users of the structures would have permanent residences in the nearby villages that were situated roughly

equidistant on a given canal system. It is not known whether this prehistoric site was the agricultural component of one or several villages.

Archaeological investigations of the Dutch Canal Ruin in 1989 and 1990 (Greenwald et al., 1994) for the expansion of the Phoenix Sky Harbor International Airport documented 14 areas of prehistoric activity within 1,800 feet of the Site with the closest area within 150 feet. An area within 400 feet of the Site, designated Area 3, was the largest concentration of habitation features located at Dutch Canal Ruin. Area 3 contained seven pit houses, 11 pits, and a rock cluster within the 129,168 square feet area. Areas 1 and 8 contained human remains, one inhumation and two cremations, respectively. Additionally, one canal alignment designated 8001, the North Main Canal, follows a trajectory that could extend into the facility. This evidence suggests the possibility that subsurface cultural resources could be present within the Site.

2.1.7 Surface Water

The primary surface water drainage in the area is the Salt River, located approximately two miles south of the Site. The normally dry Salt River flows westward across the area. Releases from Granite Reef Dam (located approximately 20 miles east-northeast of the Site) are principally responsible for flows in the Salt River.

2.1.8 Geology

The Site is located within the West Salt River Valley (SRV) sub-basin of the Basin and Range province of south-central Arizona. The landscape in this region is characterized by broad alluvial valleys separated by northwest-trending mountain ranges. The valleys are structural basins filled with thick sedimentary deposits that vary from unconsolidated to highly consolidated (Reynolds and Bartlett, 2002).

The oldest rocks in the basin are the Proterozoic metavolcanics and granite rocks (Reynolds and Bartlett, 2002). Overlying the Proterozoic rocks is a suite of Mid-Tertiary sedimentary and volcanic rocks identified as the Camels Head Formation, Tempe Formation, and Mid-Tertiary volcanics. A bedrock ridge comprised of Proterozoic and Mid-Tertiary bedrock has been identified at depths of 50 to 60 feet below ground surface (bgs) in the vicinity of Phoenix Sky Harbor International Airport (Reynolds and Bartlett, 2002).

Approximately 50 to 200 feet of Late Tertiary to Quaternary sediments overlie the Mid-Tertiary units (Reynolds and Bartlett, 2002). These sediments can be subdivided into three main units (from oldest to youngest): basin fill, Salt River gravels, and recent alluvium. The three units fill a basin that deepens to the west.

There are four distinct facies of the basin fill, varying from deposits that are nearly all silt to those that are sand with small angular pebbles (Reynolds and Bartlett, 2002). The different facies are distributed in distinct patterns across the basin, and locally define a clear stratigraphy. The most widespread type of basin fill is sand with variable amounts of silt and fine to very fine gravel.

Basin fill is overlain by coarse river gravels composed of well-rounded gravel, cobbles, and boulders in a sandy matrix (Reynolds and Bartlett, 2002). The well-rounded clasts are mostly rock types that are not present in the mountains around Phoenix. The coarse alluvium is identical to the gravels seen in the modern Salt River. In some areas, the Salt River gravels are located directly on the top of flanks of the bedrock ridge, but elsewhere the basin fill intervenes between the gravel and hard bedrock.

The youngest deposits in the basin, except for those of recent Salt River Channel, are the uppermost alluvium (Reynolds and Bartlett, 2002). This unit consists of two to 20 feet of reddish brown silt, clay, and sand with only local gravels. The unit is mostly unconsolidated and is described as being loose or loose to moderately dense with some carbonate cement.

Based upon ADEQ's *Narrative Site Information* (ADEQ, 2006), weathered bedrock at the OU2/OU3 boundary "extends from 158 to 240 feet bgs". In addition, ADEQ reports that crystalline bedrock has been "identified at about 240 ft bgs on the east side of OU3 and dips towards the west where it is encountered at 400 ft bgs."

A review of available information regarding subsurface conditions at the Site identified the presence of fill soils to a depth of approximately two feet bgs. Brown to reddish brown clay, silt, and sandy silt were observed beneath fill soils to depths of approximately 20 feet bgs. Sand, gravel, and cobbles were identified below the silt to a depth of approximately 110 feet bgs. This information is based on lithologic descriptions of drill cuttings collected during the installation of four monitor wells at the Site, and on lithologic descriptions of soil samples collected from soil borings drilled at the Site. Table 2 summarizes the monitor well construction details. Figure 2 depicts the monitor well locations. Figures 3 and 4 (SRP, 2004) depict the generalized geologic cross-sections of the Site.

2.1.9 Hydrogeology

Regionally there are three hydrogeologic units, which have been delineated in the alluvial material in the area (Bureau of Reclamation, 1976 and Corell and Corkhill, 1994). The alluvial units include the Upper Alluvial Unit (UAU), Middle Alluvial Unit (MAU), and

Lower Alluvial Unit (LAU). These units form the major water bearing formations in the SRV basin. Lithologically, the three alluvial units are described as follows (Bureau of Reclamation, 1976):

- UAU: Gravel, sand, and silt. Mostly unconsolidated with locally strong cementation near mountain fronts and major stream courses.
- MAU: Silt, siltstone, silty sand and gravel. Mostly weakly consolidated, but moderately to well-cemented. Siltstone occurs locally. Most commonly present in the center of basins, typically pinches out toward basin boundaries.
- LAU: Clay, silts, mudstone, sandstone, gravel, conglomerate, and andesitic basalt. The lower and older part of this unit is moderately to well-cemented. The upper part of this unit is weakly to well-cemented and contains interbedded sand, gravel, and conglomerate.

Groundwater contamination within the OU3 Study area occurs in the unconsolidated UAU deposits. EPA has divided this unit into four hydrostratigraphic zones: Shallow Zone (S), First Intermediate Zone (M), Second Intermediate Zone (M2), and Deep Zone (D) (Shaw, 2005).

The Shallow Zone consists of coarse-grained Salt River gravels, including minor amounts of interbedded and laterally discontinuous fine-grained deposits (Shaw, 2005). Salt River gravels, by virtue of their very coarse grain size, well-rounded clasts, and general lack of silt and clay matrix, have much greater permeabilities (Reynolds and Bartlett, 2002). The Shallow Zone begins at the water table, which is about 90 feet bgs, and the base of the Shallow Zone ranges in depth from approximately 100 to 115 feet bgs.

The First Intermediate Zone consists of interbedded coarse and fine-grained deposits dominated by gravel similar to the Salt River gravels. The First Intermediate Zone ranges in thickness from 55 to 85 feet and the base of the First Intermediate Zone is present at depths ranging from 170 to 190 feet bgs. The base of this zone frequently contains a fine-grained layer, which consists of interbedded sand, silt and clay (Shaw, 2005).

The Second Intermediate Zone contains interbedded coarse and fine-grained deposits dominated by gravel similar to Salt River gravels. This zone is located approximately 195 to 230 feet bgs. The base of this zone is marked by massive clayey/silt (Shaw, 2005).

The Deep Zone consists of an upper fine-grained layer with an underlying interval of interbedded fines and sand (Shaw, 2005). The sediments from this zone are much finer

grained than those within the Shallow and First and Second Intermediate Zones. The OU3 cores from this zone included sediments that contained brown silty clay and clayey silt with locally discontinuous sand lenses and no evidence of internal bedding (Shaw, 2005).

The bedrock units are hard with little intrinsic permeability. The main source of the permeability is faults and fractures. Permeability of basin fill is likely to be variable, corresponding to the grain size of the unit (Reynolds and Bartlett, 2002).

Groundwater within the OU3 study area is predominantly found within the unconsolidated alluvial aquifer. The alluvial aquifer is approximately 160 feet thick. The direction of regional groundwater flow in this area was generally west to southwest with a horizontal gradient of 0.003 to 0.005 feet/foot (ft/ft). The hydraulic conductivity of the aquifer reportedly ranges from 5.6 feet per day (ft/day) to 450 ft/day (ADEQ, 2006).

SRP has been conducting quarterly water level monitoring at the Site's four monitor wells (identified as 16ST-01, 16ST-02, 16ST-03, and 16ST-04) since June 2001 until June 2004 and thereafter semi-annually (Table 3). In June 2001, the depth to groundwater in the Site monitor wells ranged from approximately 75 to 76 feet bgs, with a water level elevation of approximately 1,017 feet above mean sea level (msl). In March 2007, depth to water ranged from approximately 87 to 88 feet bgs and water level elevation was approximately 1,005 feet above msl. The direction of groundwater flow is generally west with a horizontal gradient of approximately 0.001 ft/ft. Water level elevations and flow direction at the Site appear to be consistent with corresponding data for Motorola 52nd Street Superfund Site OU3 groundwater monitor wells.

The water table elevation at the Site has declined approximately 12 feet from June 2001 to March 2007. During this period, the direction of groundwater flow has remained generally toward the west. Table 3 shows the groundwater elevation measurements from June 2001 to March 2008. Figures 5 and 6 provide groundwater contour maps for the measurements collected in June 2001 and June 2004 (SRP, 2004), respectively.

2.2 PREVIOUS SITE INVESTIGATIONS

As presented in the Research Report (SRP, 2004), numerous Site investigations and sampling events have been conducted previously at the Site (Table 4 and Figure 7). The investigations have consisted of: 1) petroleum product storage tank release characterizations and petroleum product and polychlorinated biphenyls (PCBs) spill evaluations; 2) drywell sampling; 3) sump sampling; 4) a shallow soil investigation; 5) a shallow soil gas survey; and 6) installation and groundwater quality monitoring of the

four groundwater monitor wells installed at and near the Site. The aforementioned investigations, with the exception of the petroleum and PBC related investigations, have involved the analysis of COCs. Figure 7 depicts previous sampling locations at the Site, with those events not involving COCs analyses noted. Summaries of the prior investigation activities performed at the Site are provided in following sections.

2.2.1 Petroleum Product Storage and PCB Release/Spill Characterizations

The underground storage tank (UST) soil sampling activities conducted at the Site are described in more detail in earlier reports (SRP, 1998). A brief summary of this work is provided here. None of the UST soil sampling has involved analyzing for the presence of COCs. A limited investigation was performed in 1987 to evaluate the presence of PCBs in surface soil staining in the vicinity of the north Warehouse Docks at the Site (Figure 7).

From 1987 to 1993, 11 UST systems containing mineral oil, weed oil, diesel fuel, gasoline, and waste oil were removed from the Site. Releases were subsequently identified at various locations as a result of piping failures, overfilling, and/or inadequate housekeeping practices. The releases were reported to ADEQ, resulting in leaking underground storage tank (LUST) files 0520.01-.02 and 3231.01.

Drilling and sampling of borings and excavation of contaminated soil were performed to evaluate the horizontal and vertical extent of each release. In general, the heavy hydrocarbon releases were limited to shallow subsurface soils. Over 1,000 cubic yards of hydrocarbon contaminated soil was excavated and either transported to an approved facility for disposal or bioremediated at another SRP location. Confirmation samples were generally analyzed for the presence of total petroleum hydrocarbons (TPH) and/or PCBs. The three LUST files were closed by ADEQ in 1998.

UST system closure information for three additional USTs installed prior to 1940 and removed during 1950-1970 was unavailable. SRP believes that USTs were used to support the servicing of fleet vehicles that began in 1929 and this activity was performed in the Transportation Garage (Building 37). Building 37 included: USTs, a fueling island, oil and tire changing facilities and equipment, a wash rack, a machine shop, and a storage area for auto parts.

2.2.2 Sump Sampling

Liquid samples from the Transportation Garage sumps identified as SSG-19I and SSG-24I were collected in 1989 (Figure 7 and Table 4), and were analyzed for the presence of halogenated and volatile organic hydrocarbons in accordance with EPA Methods 8010/8020. Table 5 summarizes the available sump data. The following COCs

were identified in the liquid sample from sump SSG-19I: 1,1,1-TCA at 400 micrograms per liter (µg/L); PCE at 45 µg/L; and 1,1-DCA at 50 µg/L (Table 6). The liquid sample from sump SSG-24I contained 1,1,1-TCA at 970 µg/L, 1,1-DCA at 430 µg/L , and 1,1-DCE at 310 µg/L (Table 6) (*refer to Attachment I – Laboratory Certificates of Analysis, Sump Data, Fireline Investigation & Dry Well of Research Report* [SRP, 2004]).

There is no information available regarding the chemical quality of wastes contained in the other Site sumps/interceptors. However, other sumps/interceptors, SSG-14S, SSG-21T, SSG-16I (Electric Shop), and SSG-15I (Heavy Duty Garage), may possibly have contained COCs (Table 5). Transportation employees have indicated that only non-COCs containing detergent soaps have been used in the vehicle wash stall cleaning activities (SRP Employee Interviews, 2004). In addition, COCs are not suspected in the battery sump (SSG-22N), Wash Stall Sump A, SSG-13S (Building 34), SSG-17I (Building 36), SSG-20I (Building 11), SSG-23I (from SSG-17I and SSG-22N), cooling water sump (SSG-12S), or the gas island sump (SSG-18I) (Table 5).

2.2.3 Site Wide Soil Investigation

In 1989, SRP performed a voluntary soil boring investigation of the Site, which consisted of the drilling and sampling of 33 shallow soil borings as shown on Figure 7, and the collection of 27 soil samples (Shirley, 1989). Soil samples were collected at depths ranging from approximately five to seven feet bgs, generally within the fine-grained alluvial soil.

Soil samples collected during this investigation were analyzed for the following parameters:

- TPH, in accordance with EPA Method 8015 (Modified), C_6-C_{30};
- Organochlorine Pesticides and PCBs, in accordance with EPA Method 8080;
- Phenols, in accordance with EPA Method 8040; and,
- Volatile halogenated and aromatic hydrocarbons in accordance with EPA Methods 8010 and 8020, respectively, including ten of the COCs.

Concentrations of the ten COCs analytes were below the corresponding laboratory reporting limits. It was concluded that the investigation identified no significant subsurface contamination. However, it is noted that the reliability of the data are in question as the analytical laboratory reported constituent concentrations in µg/L (as opposed to the appropriate micrograms per kilogram [µg/kg]) (*refer to Attachment J – Laboratory Certificates of Analysis, Soil Boring Investigation, June 1989 of Research Report* [SRP, 2004]). Since SRP is unable to verify the data and the reportable units,

the results cannot be used to make conclusive statements regarding the level of COCs in the shallow soils in these areas. As such, SRP assessed each PSA, drywell/drywell cluster, and sump.

2.2.4 Fire Line Trench Investigation

In 1990, a release from an abandoned section of underground pipe (referred to as being located in the fire line trench) occurred north of Building 1 (SRP, 1998). The piping appeared to have been associated with two aboveground storage tanks (ASTs) located on the southwest portion of the Site that previously contained weed-oil. The release occurred when crews inadvertently struck the pipe while excavating a fire line, resulting in the release of a material resembling black sludge. Samples of the sludge in the pipeline, and a grab sample of the resulting impacted soil were collected, and analyzed for the presence of TPH, PCBs, and volatile organics, including ten of the 12 COCs (excluding 1,4-dioxane and cis-1,2-DCE).

Results of the analysis indicated that the sludge contained relatively high levels of ethylbenzene (EB) and xylenes (Table 7). COCs concentrations in the sludge were less than the reported detection limit of 2,500 μg/kg. In addition, the soil sample collected contained 1,2-dichlorobenzene (1,2-DCB) (8,700 μg/kg), 1,3-dichlorobenzene (1,3-DCB) (9,300 μg/kg), and 1,4-dichlorobenzene (1,4-DCB) (2,600 μg/kg). COCs concentrations in the soil sample were less than the reported detection limit of 250 μg/kg (*refer to Attachment I- Laboratory Certificates of Analysis, Sump Data, Fireline Investigation & Dry Well of Research Report* [SRP, 2004]). Available information indicates that the impacted soil at the release location was excavated and aerated at the Site. The remaining section of underground piping appears to have been abandoned in-place. No further evaluation of this area was conducted.

2.2.5 Drywell Investigation

In 1990, a drywell investigation consisting of sampling and laboratory analyses of sediments was performed at the Site (SRP, 1998). The drywell, identified in the Research Report (SRP, 2004) as DW-2D is reportedly located at the southwest end of the Heavy Equipment Garage (Building 34) (Figure 7). Sediment samples from three intervals were collected: three to six feet bgs; eight to 12 feet bgs; and 12 to 13 feet bgs (Table 8).

The three samples were analyzed for the presence of TPH, fuel hydrocarbons, PCBs, and VOCs, including ten of the 12 COCs (excluding 1,4-dioxane and cis-1,2-DCE). The COCs concentrations observed were all less than the reported detection limit of 500 μg/kg, with the exception of xylenes, which were detected in the two shallow

sediment samples with a maximum concentration of 7,000 µg/kg (Table 8). TPH was identified in all three sediment samples SI 16DW2-A, SI 16DW2-B, and SI 16DW2-C at concentrations of 7.8×10^5, 4.8×10^6, and 1.04×10^6 µg/kg, respectively. PCB concentrations of 2,100, 1,600, and 4,200 µg/kg were additionally identified in samples SI 16DW2-A, SI 16DW2-B, and SI 16DW2-C, respectively (*refer to Attachment I-Laboratory Certificates of Analysis, Sump Data, Fireline Investigation & Dry Well of Research Report* [SRP, 2004]). The results suggest that there has not been significant soil contamination by COCs at this location.

Other drywell locations have not been sampled; however, DW-3A, DW-3B, and DW-4, located near the Electric Shop (Building 3), are suspected of possibly having received discharges containing COCs and, therefore warranted additional investigation (Table 9). Additionally, drywells DW-1A, DW-1B, DW-1C, DW-4, DW-5A, and DW-7 warranted additional investigation based upon possible impact from areas where COCs were known or suspected. Based upon historic handling of COCs, drywells DW-2A, DW-2B, DW-2C, DW-5B, and DW-6 were not suspected to have impacts from historic handling of VOCs. However, each of these drywells/drywell clusters were investigated during the field investigation to verify the lack of significant impacts from historic operations (*Section 3.1.7*).

2.2.6 Soil Gas Survey

In 2002, a soil gas survey consisting of the collection of 54 soil gas samples from 24 locations was performed at the Site (Tracer Research Report, 2002) (Figure 7). Soil gas samples were collected generally at depths of one to five feet bgs, and were analyzed for hydrocarbons and halogenated hydrocarbons, including eight of 12 COCs (Table 10).

Based on the data presented in the 2002 Soil Gas Report (Salt River Project Soil Gas Survey Report, 2004), PCE was detected in 50 of the 54 samples analyzed with the greatest concentration of 0.09 part per million by volume (ppmv) (610.49 micrograms per cubic meter (µg/m^3)), in the sample collected at four feet bgs from location SG-23. 1,1,1-TCA was detected in nine of the 54 samples analyzed with the greatest concentration of 0.0006 ppmv (3.27 µg/m^3) in the samples collected at one feet bgs and three feet bgs from location SG-13. TCE was detected in seven of the 54 samples analyzed with the greatest detected TCE concentration of 0.004 ppmv (21.5 µg/m^3) in the sample collected at one feet bgs from location SG-23. The approximate detection limit of the three detected COCs ranged from 0.00005 to 0.0006 ppmv. 1,1-DCE, trans-1,2-DCE, cis-1,2-DCE, 1,1-DCA, and 1,2-DCA were not detected above laboratory reporting limits in any of the 54 samples analyzed. Approximate detection limits for the five COCs not detected during the investigation ranged from 0.01 to 0.2 ppmv. Overall,

the data generally indicate that there are not significant levels of soil vapors containing COCs in the shallow soils where sampled. However, because of the shallow sampling depths, these data were not used to screen out PSAs.

2.3 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) was developed that outlines the potentially complete exposure pathways at the Site (Figure 8). As described in EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation and Liability Act* (EPA, 1988), the purpose of the CSM is to describe what is known about chemical sources, migration pathways, exposure routes, and receptors. The CSM depicts the exposure pathways, which are the mechanisms by which a receptor may come into contact with the COCs in the environment.

Figure 8 presents the CSM for the Site. The remainder of this subsection outlines the four components of a complete exposure pathway.

2.3.1 Sources and Mechanisms of Release

Based on historical Site use and the results of environmental investigations, the COCs are all VOCs potentially present as a result of past practices from operations conducted at the Site. Spills or releases may have released COCs to soil from past practices or from former USTs, sumps and/or drywells.

2.3.2 Mechanisms of Transport

The COCs can migrate from soil to groundwater via infiltration, (i.e., leaching through the soil column). COCs also can migrate from soil and groundwater to indoor or ambient air through dispersion and advection. These release mechanisms result in chemicals potentially being present in the following exposure media: surface and subsurface soil, indoor air, ambient air, and groundwater.

2.3.3 Exposure Media and Routes of Exposure

The routes of exposure associated with the exposure media identified are as follows:

- Surface and subsurface soil – incidental ingestion of chemicals in soil (although this route of exposure is considered incomplete for some receptors based on the presence of buildings, asphalt and concrete at the Site). Dermal contact with soil is not considered a significant exposure pathway because the COCs are VOCs, which tend to volatilize from the soil present on the skin (EPA, 2004b).
- Indoor air – inhalation of COCs in indoor air from subsurface migration.
- Ambient air – inhalation of COCs in ambient air from subsurface migration.

- Groundwater –dermal contact and ingestion and inhalation of volatilized chemicals if groundwater is used as a source of drinking water. Because current impact from chemicals in soil to groundwater has not been demonstrated, these pathways are considered incomplete, pending additional investigation. In addition, no drinking water wells are located within OU3 and drinking water is provided by the City of Phoenix from sources outside OU3. The potential for chemical migration from soil to groundwater pathway to be complete as a result of future migration and the potential for further groundwater exposure will also be evaluated.

2.3.4 Receptors

Both current and potential future receptors have been identified at the Site. Currently, there are indoor and outdoor workers, visitors, and maintenance workers. If the Site were to be redeveloped, future receptors may include the following: residential receptors, an outdoor worker after redevelopment, and construction workers during redevelopment. Potential ecological receptors are discussed further in *Section 2.1.5*.

2.3.5 Summary of Exposure Pathways

In summary, the following potentially complete exposure pathways are present at the Site for human receptors.

- Inhalation of COCs released to soil and volatilized to indoor air. Current indoor workers and visitors, and future residents are potentially exposed via this pathway.
- Inhalation of COCs released to soil and volatilized to ambient air. Current outdoor workers, visitors, and maintenance workers; and future residents, outdoor workers, and construction workers are potentially exposed via this pathway.
- Incidental ingestion of soil containing chemicals released to the environment. Current maintenance workers; and future residents, outdoor workers, and construction workers are potentially exposed via this pathway. Because of the presence of buildings, asphalt, and concrete, current indoor and outdoor workers and current visitors are not exposed via this pathway.
- Ingestion of and dermal contact with chemicals in groundwater and inhalation of chemicals volatilized from groundwater, which were released to soil and migrated to groundwater. Future residents may be exposed via this pathway if groundwater is a source of drinking water and Site-related chemicals are detected in groundwater.

3.0 STUDY AREA INVESTIGATION AND METHODS

The Focused RI was conducted in a phased approach to determine the nature and extent of potential contamination from COCs at the Site. The general investigative activities were conducted in the following order:

- Conducted passive soil gas survey in the PSAs of concern;

- Conducted active soil gas sampling beneath the base of the sumps/interceptors and drywell/drywell clusters and performed active soil gas sampling at selected passive soil gas survey locations;
- Conducted Indoor Air Quality (IAQ) sampling to evaluate the potential impact from the vapor intrusion pathway;
- Removal of sewer interceptor grease trap SSG-15I (Sump SSG-15I) and characterization of soil in the vicinity of the sump;
- Evaluated passive and active soil gas data with EPA and selected SVMW locations, as appropriate, and evaluated the need to collect additional active soil gas samples to assess vapor intrusion pathways;
- Installed SVMWs to evaluate potential migration of detected chemicals to groundwater;
- Conducted three monthly rounds of soil vapor sampling of the SVMWs;
- Continued monitoring of the four Site groundwater monitor wells (16ST-01, 16ST-02, 16ST-03 and 16ST-04); and,
- Conducted soil sampling near SVMW-1 and SVMW-2.

The specifics of the investigation are presented in the SAP (Geomatrix, 2005c). The focus of the investigation was to determine if releases of COCs to soil have occurred and if so, to what extent has the Site been impacted. To address this concern, the field investigation approach included the following:

- Based upon previous COCs handling, storage, and disposal history as presented in the Research Report (SRP, 2004), SRP screened for COCs in soils at and around the PSAs using the GORE-SORBER™ passive soil gas technology and confirmation sampling using active soil gas sampling.
- Based upon previous COCs handling, storage, and disposal history as presented in the Research Report (SRP, 2004), and EPA's request, SRP conducted active soil gas sampling for COCs in each sump/interceptor area.
- Based upon previous COCs handling, storage, and disposal history as presented in the Research Report (SRP, 2004), and EPA's request, SRP conducted active soil gas sampling for COCs in the drywell/drywell cluster areas.
- Based upon the passive soil gas screening and active soil gas sampling results, SRP located, drilled, and installed depth specific SVMWs.
- During the drilling of the SVMWs, SRP collected appropriate field data and conducted groundwater impact modeling to determine if the COCs concentrations indicate a potential adverse impact to the environment and human health.
- Semi-annual groundwater sampling of the four Site groundwater monitor wells was conducted consistent with the OU3 groundwater sampling schedule.

- Collected additional soil samples near SVMWs to provide additional data for the groundwater impact modeling.
- The need for a nested groundwater monitor well to assess impacts to the deeper hydrostratigraphic zones from the Site was evaluated after the initial soil investigation and groundwater impact modeling was completed.

3.1 POTENTIAL SOURCE AREAS, SUMPS/INTERCEPTORS, AND DRYWELLS

The PSAs were identified based on whether COCs were known or suspected to have been used, stored or released at the various operations. If the COCs were known or suspected to be at the various operations, each area was evaluated based on the following potential release points: 1) ground surface; 2) drains; 3) sumps/interceptors; and/or 4) drywells. The concentrations of COCs associated with these structures were unknown. Five PSAs that warranted further investigation at the Site were: PSA 1 – the ground surface north and east of Building 3, formerly located in the southwest corner of the Site; PSA 2 - the ground surface, drains, and sumps associated with the Transportation (Building 37), Repair (Building 11), and Heavy Equipment Garages (Building 34) in the western half of the Site; PSA 3 – the Salvage Yard located at the southeastern corner of the property; PSA 4 – the area east of Building 1; and PSA 5 – the area on the south and north sides of Warehouse Building 20.

Additionally, potential release points (i.e. sumps/interceptors and/or drywells/drywell clusters) outside of the suspected potential source areas were investigated utilizing active soil gas sampling techniques. Figure 9A shows the PSAs and potential release points within the defined PSAs. Details of each PSA are described in this section. Details of past and present use of the sumps and drywells outside of the PSAs are also included.

3.1.1 PSA 1

PSA 1 includes the southwest corner of the property, the area north and east of former Building 3. Building 3 was the site of the Electric Shop from 1951 to 1974 and the Transportation Department from 1975 to 1995. COCs were used to clean transformers at the Electric Shop from approximately 1964 to 1974. PSA 1 was identified because cleaning solvents containing COCs could have been released to the ground surface in this area and reportedly have been released to a nearby sewer interceptor grease trap (SSG-16I) (Figures 9A and 9B). While the catch basin structure was connected to the City of Phoenix storm drain at the southern property boundary, the construction was such that it has been identified as a drywell.

Solvents may have been released to the ground surface on the east side of Building 3 where Electric Shop crews dispensed solvent from 55-gallon drums into smaller

containers. One employee also reported that solvent dispensing valves may have leaked (SRP Employee Interviews, 2004). Although the drums were stored on a concrete slab, there was a possibility that some solvent may have been released to the ground surface.

Similarly, solvents may have been released to the ground surface on the north side of Building 3 where SRP crews used spray guns to spray solvent on transformers. Although extra solvent was captured and cleaning was performed on a concrete apron, it is possible that solvent may have been released to the ground surface during these cleaning operations.

Waste solvent and wastewater containing solvent has reportedly been discharged to the sewer interceptor grease trap (SSG-16I) at the north end of the Electric Shop from steam cleaning activities and from washing out solvent dip tanks (Figures 9A and 9B). Prior to 1965, before the installation of sewer interceptor grease trap SSG-16I, any wastewater generated from cleaning activities would have been discharged to the ground surface, and would likely have been drained to the reported catch basin and gravel well (DW-3A and DW-3B) located at the northeast corner of the Electric Shop (Figures 9A and 9B). Drywells DW-3A, DW-3B, and DW-4 were assessed through active soil gas sampling techniques (Figures 9A and 9B and Table 9).

Active soil gas samples ASG-5 (next to drywell DW-4), and ASG-9 (next to SSG-16I and drywells DW-3A and DW-3B) and samples from passive soil gas GORE-SORBER™ locations SG-15 and SG-16 were used to evaluate potential releases of COCs to the soil at this PSA (Figures 9A and 9B).

3.1.2 PSA 2

PSA 2 includes the storm and sanitary sewer drains and sumps associated with Garage Building 37 (PSA-2A), 11 (PSA-2B), and 34 (PSA-2C). Solvents reportedly have been released to floor drains in Building 34, inside the Repair Garage, and to the ground surface near Building 11. Liquid samples collected from Garage sumps SSG-19I and SSG-24I that service the Transportation Garage (Building 37) contained 1,1,1-TCA and PCE. Drywells DW-2A, DW-2B, DW-2C, and DW-2D do not appear to be potentially impacted by COCs, but were assessed for COCs using active soil gas sampling techniques (Figures 9A through 9C and Table 9).

Active soil gas samples were collected below the base of drywell clusters DW-2A/-2C and DW-2B/-2D. In addition, sumps SSG-14S (PSA-2A) and SSG-15I (PSA-2C) were located and was assessed for COCs using active soil gas sampling techniques (Figures

9A through 9C and Table 5). Soil gas samples from the following passive soil gas GORE-SORBER™ locations PSA-2A (SG-30, SG-31, SG-32, SG-36), PSA-2B (SG-25, SG-26, SG-27, SG-28, SG-29, SG-34), and PSA-2C (SG-13, SG-14, SG-17, SG-18, SG-21, SG-22, SG-23, SG-24) were used to address potential COCs impacts to soil within PSA-2 (Figure 9A). Active soil gas samples from locations ASG-4, ASG-6, ASG-7, ASG-8, ASG-10, ASG-11, ASG-12, ASG-13, ASG-14, and ASG-15 were used to evaluate the potential COCs impact to soils within or near PSA-2 (Figures 9A through 9C).

3.1.3 PSA 3

PSA 3 includes the southeast corner of the Site and was identified because waste solvents were apparently stored at this location during the mid-to-late 1980s. There is no evidence to suggest that the drywell DW-6 at the Salvage Building/Salvage Shed was used for disposal of waste solvents (Figure 9A and Table 9). However, it was possible that some small quantities of waste solvent may have been discharged to the ground surface near the Salvage Shed when drums with residual waste solvent were crushed at this location; therefore, drywell DW-5A was located and assessed for COCs using active soil gas sampling techniques (Figure 9A and Table 9). There is no evidence to suggest that drums stored in the Salvage Building/Salvage Shed leaked or were spilled.

Soil gas samples from passive soil gas locations SG-1, SG-2, SG-3, SG-4, SG-5, SG-6, SG-7, SG-8, SG-9, SG-10, and SG-11; and from active soil gas sampling locations ASG-1 and ASG-2 were used to evaluate potential COCs impact to soils within or near PSA-3 (Figure 9A). In addition, active soil gas samples were collected from ASG-25 and ASG-26 to further evaluate the areas around SG-4 and SG-6, respectively, in PSA-3.

3.1.4 PSA 4

PSA 4 includes the gravel wells and catch basins that were reported on a 1951 Site Drainage Map (Figure 9A). These are identified as drywells DW-1A, DW-1B, and DW-1C. This area may have received runoff from the Material Reclamation/Salvage area. These drywells were located and assessed for COCs. Active soil gas samples from location ASG-3 were used to evaluate potential COCs impacts to soil within PSA-4 (Figure 9A). No passive soil gas sampling was conducted for this PSA.

3.1.5 PSA 5

PSA 5 includes the south side of Warehouse Building 20, near a loading dock and includes the area north of Warehouse Building 20 (Figures 9A and 9C). Solvents containing COCs were reportedly handled and/or stored at these locations. Although there is no information to indicate a release in this area, it was conceivable that solvent

drums received by the Warehouse could have been punctured during unloading, or that solvent drums leaked or were spilled. DW-7 was within PSA-5 and was assessed for COCs using active and passive soil gas sampling techniques. An active soil gas sample was collected from ASG-16 to evaluate the area around DW-7. Passive soil gas locations SG-37, SG-38, and SG-39 were used to evaluate potential COCs impacts to soil within PSA-5.

DW-7 was within PSA-5 and was assessed for COCs using active soil gas sampling techniques. Passive soil gas locations SG-37, SG-38, and SG-39 were used to evaluate potential COCs impacts to soil within PSA-5 (Figure 9C).

3.1.6 Sumps/Interceptors

Of the 14 sumps/interceptors that were installed at the Site, 13 serviced the Garage and Transportation operations and one serviced the Power C & M Electric Shop activities (Figure 9A). In 1989, SRP developed and implemented a program to modify and upgrade several of its sumps to ensure compliance with City codes. Table 5 summarizes the sump/interceptor information.

The following sumps/interceptors were installed to support Garage and Transportation and the Power C & M Electric shop operations:

PSA-1

- SSG-16I for the collection of oily waste and wash water from transformer steam cleaning activities at the north end of the Power C & M Electric Shop (Building 3).

PSA-2A

- SSG-14S for the collection of oily waste from the Transportation Garage lube pit.
- SSG-17I for the collection of vehicle wash water from the Building Structure 36 Wash Stall.
- SSG-18I for the collection of oily waste runoff from the Transportation Garage gas island.
- SSG-19I for the collection of oily waste from the Transportation Garage.
- SSG-22N for the collection of battery waste from the Battery Building (Building 39).
- SSG-24I for the collection of oily waste from the Transportation Garage.

PSA-2B

- Sump A presumably for the collection of vehicle wash water from a wash rack at the southeast corner of the Transportation Garage (Building 37).
- SSG-20I for the collection of vehicle wash water from the Building 11 Wash Stall.
- SSG-21T for the collection of floor drainage from the Repair Garage (Building 11).
- SSG-23I for the collection of oily waste from SSG-17I and SSG-22N.

PSA-2C

- SSG-12S for the collection of evaporative cooling water (southeast end of Building 34).
- SSG-13S for the collection of vehicle wash water from the steam and cleaning rack at the loading ramp at the south end of the Heavy Equipment Garage (Building 34).
- SSG-15I for the collection of floor drainage from the Heavy Equipment Garage (Building 34).

PSA-3, PSA-4, and PSA-5

- There are no current or previously existing sumps/interceptors identified in these three PSAs.

SSG-13S, SSG-15I, SSG-23I, SSG-24I, and Sump A have been connected to the sanitary sewer, while SSG-12S, SSG-18I, SSG-19I, SSG-20I, and SG-21T have been connected to the storm drain. SSG-14S, SSG-17I, and SSG-22N have been connected to the sanitary sewer since 1989. Prior to that time, these sumps were connected to the storm drain. SSG-16I was connected to the storm drain system east of Building 3; however, prior to 1979, this storm drain system had been connected to a catch basin at the southern property boundary. In 1979, the City of Phoenix identified this catch basin as a drywell, which is referred to as DW-4 (Figures 9A and 9B and Table 5).

Sump A was removed from service in approximately 1958; SSG-18I and SSG-19I were removed from service in 1993 and 1989, respectively. In addition, SSG-13S, SSG-20I, and SSG-22N are no longer in use. In November 2006, SSG-15I was removed because it was no longer an active sump and it was unknown if the sump had received Site COCs (Table 5). Details of sump removal activity are provided in *Section 3.4*.

All sump/interceptors were investigated by collecting active soil gas samples and analyzing the samples for VOC analysis from below the base of each sump/interceptor (Figure 9A).

3.1.7 Drywells

There have been a total of 14 drywells, reported or confirmed, at the Site. Figure 7 shows the locations of the drywells. Table 9 presents a summary of the drywell information. Ten of the 14 drywells reportedly were catch basins or gravel drain wells, constructed in the early 1950s, to provided drainage for the Site (SRP, 2004). Based on the available information, the catch basins and gravel drain wells generally were constructed to a depth of approximately 10 to 12 feet bgs or to the sand and gravel unit. These drainage features are identified as DW-1A, DW-1B, and DW-1C; DW-2A, DW-2B, DW-2C, and DW-2D; DW-3A and DW-3B; and DW-4 (Figure 7).

As SRP developed the storm drain system at the Site, it appears that at least some of these drainage features were paved over and were probably filled in with gravel. A drywell search conducted at the Site in 1991 confirmed the presence of a few of these drainage features, believed to be DW-2D, DW-1C, and DW-1A or DW-1B (Powers, 1991). DW-2D was filled in with gravel and cobbles to within three feet of the top of the drywell and paved over with asphalt.

The remaining four drywells, DW-5A and DW-5B; DW-6, and DW-7, are shown on various SRP Site drawings as listed in Table 9 or other records and only one has been confirmed. The following information was obtained from the SRP Site drawings:

- A 1954 SRP drawing, A-78-1.1 indicated the presence of a drywell (DW-5A) inside the Salvage Shed (Building 5) (Figure 9A). A pit approximately four feet by six feet wide and one foot deep with a 2-inch drain opening to the drywell was indicated on the aforementioned drawing. It appears that this drywell was intended to drain a nearby evaporative cooler. A 1972 note on the drawing indicated that the pit was capped.
- A second drywell (DW-5B) was apparently constructed outside of and adjacent to the Salvage Shed in 1972. This drywell was filled in with concrete in the 1990s (SRP Employee Interview, 2004).
- A 1954 drawing, A-84-6.1, showed a third drywell (DW-6) at the east end of Building 7 - Meter Shop Addition. It appeared that the drywell was installed to collect condensation from a refrigeration unit at the east end of the building. Drywell DW-6 may have been filled in with gravel or paved over with asphalt when Building 7 was demolished in the mid-to-late 1970s.
- Drywell DW-7 located at the northwest corner of the property, apparently was intended to collect drainage from the roof of the South Warehouse Dock (Building 22) or runoff from the area. The drywell may have been filled in with gravel and covered when the area was paved, but the date is unknown.

Eight drywells, DW-1A, DW-1B, DW-1C, DW-3A, DW-3B, DW-4, DW-5A, and DW-7, were located and assessed to determine if they have been impacted by COCs. Based on historical information provided in the Research Report (SRP, 2004), drywell locations DW-3A, DW-3B, and DW-4, located near the Electric Shop (Building 3), were suspected of possibly receiving discharges containing COCs. Additionally, drywells DW-1A, DW-1B, DW-1C, DW-5A, and DW-7 were in areas that could have been impacted by COCs. The other drywell/drywell cluster locations (DW-2A, DW-2B, DW-2C, and DW-2D; DW-5B, and DW-6) were also investigated to assess potential impacts from historical operations at the Site.

3.2 PASSIVE AND ACTIVE SOIL GAS INVESTIGATION

Passive soil gas and active soil gas surveys were conducted at the Site during the initial phase of the Focused RI. The passive soil gas investigation was conducted from November 21 through 23, 2005. The active soil gas investigation was conducted in two phases. The initial phase of active soil gas sampling was performed between November 15 and 17, 2005. Based on the results from the initial phase, Phase II of the active soil gas investigation was conducted in June 2006.

The *Technical Memorandum Regarding the Initial Phase of the Focused Remedial Investigation, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated April 20, 2006 (Geomatrix, 2006a) was submitted to EPA, which provided details of the passive and active soil gas investigations.

3.2.1 Passive Soil Gas Sampling

The purpose of the passive soil gas survey was to screen for the presence of COCs near the sewer and storm drain piping in PSA 1, PSA 2, PSA 3, and PSA 5, where COCs were reportedly stored. There were a total of 43 passive soil gas sampling locations (SG-1 through SG-40; SGB-1, SGB-2, and SGB-3) that were sampled during this study (Figure 9A). SGB-1, SGB-2, and SGB-3 were selected as background locations for the passive soil gas survey. Sampling locations were chosen based upon the Site's historical COCs handling, storage, and disposal as presented in the Research Report (SRP, 2004). The results from these locations assisted in determining any residual background COCs concentrations. The purpose of the sampling locations "outside" of the PSA areas was to provide information for two-dimensional contouring of the COCs at the Site. The passive soil gas sample locations "outside" of the PSA areas included: SG-12, SG-19, SG-20, SG-31, SG-33, SG-35, and SG-40. The sample spacing was approximately 50 to 75 feet in and/or near the PSAs, which was adequate for screening purposes. 1,4-dioxane was not analyzed during the passive soil gas survey.

3.2.1.1 GORE-SORBER™ Modules and Installation

Passive soil gas sampling was conducted using GORE-SORBER™ modules, developed by Gore. The modules provided semi-quantitative data with respect to vapor mass of a given analyte in proximity to the module location. Each GORE-SORBER™ module consisted of several separate passive sorbent collection devices (sorbers). One of the sorbers was used as the sample, while the remaining sorbers served as replicate samples. A typical sorber is 15 to 25 millimeters (mm) in length and has a 3-mm inside diameter. Each sorber contained 40 milligrams (mg) of a granular sorbent material suitable for the specific compounds to be detected. Typically, polymeric and carbonaceous resins are used as sorbent materials because of their affinity for a broad range of VOCs. The sorbers were sheathed in the bottom of a one-foot long vapor-permeable cord that is shaped in a loop. The loop is used as a means of tying the modules to a string for installation and retrieval.

GORE-SORBER™ modules were installed by drilling a ¾-inch to 1-inch diameter hole using a handheld drill equipped with a 3-foot long auger bit at each proposed sampling location. The GORE-SORBER™ modules were installed at a depth of approximately 2.5 feet bgs at each sampling location. The module was removed from its sealed shipping vial, tied to an approximate 4-foot long nylon cord, and inserted in the bottom of the hole. The nylon cord was then fastened to a cork, which was tamped flush with the ground surface. Where sample locations were installed in asphalt or roadways that may encounter car or truck traffic, the corks were not extended above the road surface.

The modules remained in the ground for approximately 16 to 20 days, after which, each module was removed. To retrieve each module, the cork was removed from the ground and the module was pulled out by the nylon cord. The cork and nylon cord were separated from the module and discarded. The exposed modules were resealed in their respective shipping vials, labeled, and placed in the shipping box supplied by Gore. Each hole was then sealed using bentonite or neat cement grout, and patched at the surface to match the existing pad (concrete or asphalt).

Drill bits used to create the subsurface opening for installing the GORE-SORBER™ modules were decontaminated prior to each use. Equipment was cleaned by using a non-phosphate detergent mixed with distilled water, and rinsing twice with distilled water.

3.2.2 Active Soil Gas Sampling

The purpose of the active soil gas sampling was to evaluate potential releases of COCs to the soil through the Site sumps, interceptors, and drywells. AMEC Geomatrix conducted active soil gas sampling at 17 locations (Figures 9A through 9C). Active soil

gas sampling was conducted below the base of the sumps/interceptors and drywell/drywell clusters in accordance with the RI/FS Work Plan (Geomatrix, 2005b). Based on historical SRP documents, it appeared that the drywells were drilled to the top of the coarse-grained sediments. In addition to the 17 active soil gas samples collected below the base of the sumps/interceptors and drywell/drywell clusters, five shallow active soil gas samples were collected to provide comparison results to the passive soil gas data. A background active soil gas sample, BASG-1, was also collected near the background passive sample, SGB-3 (Figures 9A through 9C).

Based upon previous COCs handling, storage, and disposal history as presented in the Research Report (SRP, 2004), the following four sumps/interceptors may have been impacted by COCs:

- SSG-14S (Transportation Garage);
- SSG-21T (Battery Shop);
- SSG-16I (Electric Shop); and,
- SSG-15I (Heavy Duty Garage).

In addition, the following eight drywells/drywell clusters were located and assessed for impacts by COCs:

- DW-1A, DW-1B and DW-1C Cluster;
- DW-2A and DW-2C Cluster;
- DW-2B and DW-2D Cluster;
- DW-3A and DW-3B Cluster;
- DW-4;
- DW-5A and DW-5B Cluster;
- DW-6; and,
- DW-7.

The sumps/interceptors and drywell/drywell clusters are associated with the following PSAs:

Potential Source Area	Drywells/Drywell Clusters	Sumps/Interceptors
PSA-1	DW-3A, DW-3B, DW-4	SSG-16I
PSA-2A	None	SSG-24I, SSG-14S, SSG-19I, SSG-18I, SSG-17I, SSG-22N
PSA-2B	None	SUMP A, SSG-21T, SSG-23I, SSG-20I
PSA-2C	DW-2A, DW-2B, DW-2C, DW-2D	SSG-15I (Removed), SSG-13S, SSG-12S
PSA-3	DW-5A, DW-5B, DW-6	None
PSA-4	DW-1A, DW-1B, DW-1C	None
PSA-5	DW-7	None

In accordance with the FSP (Geomatrix, 2005c), each sump/interceptor and drywell/drywell cluster was located and active soil gas samples were collected below the base of each of the structures.

Active soil gas samples were collected using a direct-push drilling method. Johnson Environmental Technologies (JET) performed the drilling. Drilling was conducted by pushing hollow steel rods, outfitted with a steel sampling tip, into the subsurface using a hydraulic high impact hammer system. Each soil boring was drilled below the approximate base of the structures being investigated.

Prior to initiating the drilling of each active soil gas boring, new Teflon® tubing was installed and connected to the sampling tip through the drive rods. The sampling system was checked for leaks by applying a vacuum to the system and observing if the vacuum decreases after the vacuum was no longer being applied. The vacuum was checked prior to beginning each direct-push boring.

The leak detection methodology applied during the soil gas sampling of SVMW-1 and SVMW-2 followed the approach specified in *Section 2.7.7* Tracer Gas of the *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, October 2006 (New York, 2006). This procedure involves enriching the atmosphere in the immediate vicinity of the area where the probe intersects the ground surface with a tracer gas, such as helium, 1,1-diflourethane, isobutylene, hexane or other suitable gas. Either a plastic pail was used to keep the tracer gas in contact with the probe during the testing or clean rags were soaked with the tracer gas and placed around the fittings and joints. When the plastic pail was utilized, a portable monitoring device was used to collect a sample prior to and after sampling for the COCs. The advantage of using isobutylene was the

ability to monitor for the presence of this compound using a MiniRae 2000 photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp. The reason the leak detection compound, 1,1-diflourethane is presented as a tentatively identified compound (TIC) is because this is the chemical that was used for some of the leak detection testing and this compound is not part of the standard target analyte list for the EPA Test Method TO-15. Therefore, 1,1-diflourethane was added as a TIC to the standard EPA Test Method TO-15 analyte list.

Active soil gas samples were collected after driving the probe rods to the desired depth. Once the desired depth was reached, the tip was exposed to the subsurface by pulling back the drill rod. A vapor collection receptacle (VCR) was used to control and monitor purging. The purge volume was established after the purge volume test described was completed (*Section 3.2.2.1*).

The active soil gas samples were collected by attaching a one-Liter Silonite canister to the VCR sampling point tubing and opening the canister. Prior to use, the canisters were certified clean by Aerotech Environmental Laboratories (AEL), an Arizona Department of Health Services (ADHS) certified laboratory (AZ0610) and evacuated to greater than 25 inches of mercury by the laboratory. Flow into the canister was controlled by a laboratory provided quick connect flow control restrictor that was set to allow approximately 200 milliliters/minute (mL/min) into the canister. The vacuum in the canister extracted the sample from the subsurface. After sampling for an appropriate amount of time (depending on the flow control restrictor and canister volume), the canister valve was closed, the flow restrictor was disconnected from the canister, and sample inlets were capped before samples were submitted to the laboratory.

A total of 29 active soil gas samples were collected in certified clean one-Liter Silonite canisters. Seven of the active soil gas samples collected by AMEC Geomatrix were Quality Assurance/ Quality Control (QA/QC) samples. QA/QC samples collected included three duplicate samples, two equipment blanks, and two field blanks. All the samples were submitted to AEL, under standard chain-of-custody procedure. The Silonite canisters were analyzed for VOCs by EPA Test Method TO-15, including 1,4-dioxane and 1,1-diflouroethane as a TIC.

Reusable equipment for active soil gas sampling, such as the drill rod and sampling point was steam cleaned between each boring. Only deionized (DI) water was used for decontamination of drilling equipment. The Teflon® tubing was disposed of between each boring location.

3.2.2.1 Purge Volume Test – Active Soil Gas Sampling

A purge volume test was performed at ASG-01 on October 24, 2005. JET performed the drilling using direct push drilling techniques. Coarse grained sediments were encountered at 11 feet bgs. Refusal of the direct push sampling rod occurred at 13 feet bgs. Soil vapor samples were collected in 1-Liter Silonite canisters, which were certified clean by AEL. Purging of each sample was performed at approximately 200 mL/min. Sampling was performed at an extraction rate of approximately 500 mL/min. Sample ASG-01-01 was collected after one purge volume (equivalent to the volume of the sample tubing) was removed. A single purge volume of the sample tubing was 0.093 liters. During collection of the initial sample, ASG-01-01, approximately 10.8 purge volumes of subsurface air were removed to fill the Silonite canister. Prior to collecting sample ASG-01-03, one purge volume of the sample tubing was extracted from the subsurface. During collection of ASG-01-03, approximately 10.8 purge volumes of subsurface air were removed to fill the Silonite canister. Prior to collecting sample ASG-01-07, one purge volume of the sample tubing was extracted from the subsurface. During collection of ASG-01-07, an additional 10.8 purge volumes of subsurface air were removed to fill the Silonite canister.

Of the 12 Site COCs, only PCE was detected in the active soil gas purge volume test samples. Detected soil vapor concentrations were 56 parts per billion volume (ppbv), 60 ppbv, and 70 ppbv, in soil gas samples ASG-01-01, ASG-01-03, and ASG-01-07, respectively. The analytical results for the three samples were not significantly different (25 percent [%] or less). Based on the purge volume test results, AMEC Geomatrix recommended collection of the soil gas samples after the removal of three purge volumes at each active soil gas sample location. This purge volume corresponds with the default purge volume provided in the *Appendix A* of the FSP (Geomatrix, 2005b).

3.3 SOIL VAPOR MONITOR WELLS

The purpose of the installation and sampling of the SVMWs was to assess the degree, if any, of potential contamination by the COCs in the vadose zone at two selected locations. Based on review of the active and passive soil gas sampling results, and after a planning meeting between the EPA and SRP, the locations of the two SVMWs were identified (Figure 10). The two multiport SVMWs were installed at the locations where the greatest PCE concentrations in the active soil gas samples were observed, in accordance with the RI/FS Work Plan (Geomatrix, 2005b). Boring SVMW-1 was advanced within five feet of active soil gas boring ASG-5. Boring SVMW-2 was advanced within five feet of active soil gas boring ASG-9. The SVMW investigation and installation activities occurred between January 22 and 26, 2007. Boart Longyear Company of Phoenix, Arizona (Arizona Department of Water Resources [ADWR]

Driller's License No. 83) provided the drilling and installation services under the supervision of AMEC Geomatrix personnel.

Two SVMW borings (SVMW-1 and SVMW-2) were advanced at the Site and four SVMW ports were installed within each boring (Figures 11 and 12). The depth-specific SVMWs were constructed at suspected contaminant source areas to assess the potential impacts, if any, that COCs may have on underlying groundwater resources and to estimate the mass of gaseous phase COCs in the vadose zone. Figures 11 and 12 and Table 11 presents the depths of the screened intervals of the SVMW ports installed in each boring. After installation of the eight soil vapor monitoring ports, the wells were sampled in accordance with the RI/FS Work Plan (Geomatrix, 2005b).

AMEC Geomatrix's SVMW installation activities included the following tasks:

- Drill two SVMWs using sonic continuous core drilling method to a depth of 85 feet bgs.
- Prepare lithologic descriptions of materials derived from each 2.5 foot interval during advancement of the 9-inch borehole. The lithologic descriptions included detailed observations of sample color, size distribution (Wentworth scale), angularity-roundness, sorting, and minerals visible in the coarse fraction. The description and approach for classifying the soils were in general accordance with the Uniform Soil Classification System.
- Collect soil samples for analysis of soil physical properties from selected intervals.
- Screen downhole VOC vapor concentrations utilizing a MiniRae 2000® PID equipped with an 11.7 eV lamp for screening VOCs.
- Install four SVMW ports within each borehole.
- Properly dispose investigation derived wastes (IDW).

The SVMW installation field activities were performed in general accordance with the RI/FS Work Plan (Geomatrix, 2005b). The SVMW installation field procedures are presented in the FSP of the RI/FS Work Plan (Geomatrix, 2005c). The SVMW installation activities are reported in the *Final Soil Vapor Monitor Well Installation Report, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated April 23, 2007 (Geomatrix, 2007a). Approval from EPA of the aforementioned report was received on May 2, 2007 (EPA, 2007a)

3.3.1 Soil Sampling of SVMW-1 and SVMW-2

During the drilling of SVMW-1 and SVMW-2, soil samples were collected and analyzed for the following physical parameters:

- Soil moisture content;
- Total organic carbon (TOC);
- Grain size distribution (sieve analysis); and,
- Bulk density.

The above listed parameters are necessary input parameters to the models for evaluating potential chemical migration to groundwater (see *Section 7.0*).

3.3.1.1 Soil Sampling Procedures

Soil samples were collected after the core was removed from the subsurface in 2.5-foot sections. One stainless steel liner tube was pushed into each 2.5-foot core sample and the remaining core was placed into two and half or five-gallon buckets, which were sealed for transport to the laboratory. The stainless steel liner tubes were sealed at the ends with Teflon® sheets and plastic caps. The caps were fixed to the tubes with non-VOC containing tape. A label documenting the date, location, boring number, depth to sample, and the sampler's signature were located on the tube and the sampling buckets. A chain-of-custody form was completed with the required information to identify requested sample analyses and sample custody. AMEC Geomatrix submitted samples to Terracon Consultants, Inc. under standard chain-of-custody procedures.

3.3.1.2 Field Screening of Soil Samples

Soil samples were monitored for organic vapors using a PID. The screening equipment was calibrated against isobutylene gas having a concentration of 100 parts per million (ppm). Monitoring of soil samples was performed by placing the desired amount of the excavated/core sample of soil into a plastic bag. The bag was then sealed and the soil was broken up inside the bag. The PID probe was then inserted into the bag to monitor the headspace. The PID readings ranged from 0.0 to 1.5 ppm for boring SVMW-1 and 0.0 to 4.0 ppm for boring SVMW-2.

3.3.1.3 Equipment Decontamination

The drill rig was decontaminated before it was mobilized to the Site. Drilling equipment was decontaminated by steam cleaning after drilling each soil boring. Soil sampling equipment (stainless steel sleeves and plastic caps) was decontaminated prior to

collection of each soil sample by scrubbing with Alconox® (a laboratory-grade detergent) and distilled water or DI water, followed by double rinsing with distilled water or DI.

3.3.2 Monthly Soil Vapor Monitor Well Sampling

After the SVMW installation and purge test, AMEC Geomatrix conducted three rounds of soil vapor sampling in accordance with the RI/FS Work Plan (Geomatrix, 2005b) and the FSP (Geomatrix, 2005c). The three sampling events were conducted in April, May, and June 2007. The following sections describe the field activities for each sampling event.

3.3.2.1 Purge Volume Test – Monthly SVMW Sampling

AMEC Geomatrix performed a purge volume test on March 6, 2007. The purge test was conducted on the soil vapor wells in boring SVMW-2 to establish the number of purge volumes that would be used during soil vapor monitoring activities. Based on the results of the purge test, AMEC Geomatrix recommended that three purge volumes be used for SVMW-1-4 and SVMW-2-4, which are located in the fine grained unit, prior to collecting soil vapor samples. Additionally, the purge test results indicated that seven purge volumes should be used prior to sampling SVMW-1-1, SVMW-1-2, SVMW-1-3, SVMW-2-1, SVMW-2-2, and SVMW-2-3, which are located in the Salt River gravels.

AMEC Geomatrix's letter report titled *Summary of Purge Test Data, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated April 2007 (Geomatrix, 2007b) presents the results of the purge volume test (including laboratory analytical data) and associated activities. EPA approved AMEC Geomatrix's letter report for Purge Test Data on May 17, 2007 (EPA, 2007b).

3.3.2.2 Month 1 Sampling – April 18, 2007

The soil vapor sampling for Month 1 was conducted on April 18, 2007 for SVMWs in boring SVMW-1 and boring SVMW-2. Prior to initiating purging and sampling activities, the relative subsurface pressure was measured at each well port utilizing a Magnehelic® gauge with a measurement range of 0.0 to 0.5 inches of water. The relative subsurface pressures for SVMW-1-1, SVMW-1-2, SVMW-1-3, and SVMW-1-4 ranged from positive (+) 0.02 to +0.075 inches of water. Relative subsurface pressures measured at SVMW-2-1, SVMW-2-2, SVMW-2-3, and SVMW-2-4 ranged from +0.025 to +0.05 inches of water.

AMEC Geomatrix conducted parallel purging activities at SVMW-1 and SVMW-2 prior to collecting soil vapor samples, utilizing two vacuum pumps. Purging occurred at a flow rate of approximately 200 mL/min. A calibrated PID was used to monitor the subsurface air removed from each well port during purging. AMEC Geomatrix purged seven

volumes of subsurface air from wells SVMW-1-1, SVMW-1-2, SVMW-1-3, SVMW-2-1, SVMW-2-2, and SVMW-2-3. The PID readings collected at each well during purging were 0.0 ppm. Three purge volumes of subsurface air were removed from wells SVMW-1-4 and SVMW-2-4. The PID readings collected at each well port during purging were 0.0 ppm.

Eleven soil vapor samples were collected in certified clean 1-Liter SUMMA canisters provided by Transwest Geochem, Inc. (Transwest), ADHS certified laboratory (AZ0133). The SUMMA canisters were equipped with a flow-metering orifice certified at the desired sampling rate of 200 mL/min. Pursuant to the RI/FS Work Plan (Geomatrix, 2005b) and QAPP (Geomatrix, 2005c), three of the samples collected on April 18, 2007 were for QA/QC, which included one duplicate sample from SVMW-2-1, an ambient/field blank, and an equipment blank.

The samples were submitted under chain-of-custody protocol to Transwest on April 19, 2007 for analysis of VOCs by EPA Test Method TO-15, including 1,4-dioxane and 1,1-diflouroethane as a TIC. Transwest subcontracted Columbia Analytical Services (CAS) of Simi Valley, California (ADHS certified laboratory AZ0694) to conduct the analyses. 1,1-diflouroethane was used as a tracer compound to detect leaks within the sampling train during sampling activities.

3.3.2.3 Month 2 Sampling – May 22, 2007

AMEC Geomatrix conducted the soil vapor monitoring for Month 2 at SVMW-1 and SVMW-2 on May 22, 2007. Prior to initiating purging and sampling activities, the relative subsurface pressure was measured at each well port utilizing a Magnehelic® gauge with a measurement range of 0.00 to 0.50 inches of water. Relative subsurface pressures for SVMW-1-1, SVMW-1-2, SVMW-1-3, and SVMW-1-4 ranged from 0.00 to +0.095 inches of water. The range of relative subsurface pressures measured at SVMW-2-1, SVMW-2-2, SVMW-2-3, and SVMW-2-4 were between 0.00 to +0.025 inches of water.

Parallel purging activities were conducted, as per Month 1, at a flow rate of approximately 200 mL/min. A calibrated PID was used to monitor the subsurface air removed from each well port during purging. Seven purge volumes of subsurface air were removed from wells SVMW-1-1, SVMW-1-2, SVMW-1-3, SVMW-2-1, SVMW-2-2, and SVMW-2-3 prior to soil vapor sampling. The PID readings collected at each well during purging were 0.0 ppm, except at SVMW-1-1, which had a maximum PID reading of 0.2 ppm. Three purge volumes of subsurface air were removed from wells SVMW-1-4 and SVMW-2-4 before sampling. The PID readings collected at each well during purging were 0.0 ppm.

AMEC Geomatrix collected eleven soil vapor samples in certified clean 2.4-Liter SUMMA canisters provided by Transwest and equipped with a flow-metering orifice certified at the desired sampling rate of 200 mL/min. Three of the eleven samples collected were for QA/QC, which included one duplicate sample from SVMW-2-1, an ambient/field blank, and an equipment blank.

The samples were submitted under chain-of-custody protocol to Transwest on May 23, 2007 for VOC analysis by EPA Test Method TO-15, including 1,4-dioxane and isobutylene as a TIC. Transwest subcontracted CAS to conduct the TO-15 analysis. Isobutylene (at a concentration of 100 ppm) was used as the tracer compound to detect leaks within the sampling train.

The tracer compound for the leak detection evaluation was switched from 1,1-diflouroethane to isobutylene to allow for on-Site qualitative field analysis of the tracer compound. By using a known concentration of isobutylene in an enclosed cover, we were able to apply the New York Guidance Criteria of 10% saturated vapor pressure for an acceptable tracer test (New York, 2006). However, when 1,1-difluoroethane was sprayed on the rags and wrapped around the joints, this method did not allow for on-Site field quantifiable results.

3.3.2.4 Month 3 Sampling – June 20, 2007

AMEC Geomatrix performed the soil vapor monitoring for Month 3 at SVMW-1 and SVMW-2 on June 20, 2007. The relative subsurface pressure was measured at each well port prior to sampling utilizing a Magnehelic® gauge with a measurement range of 0.00 to 0.50 inches of water. Relative subsurface pressures for SVMW-1-1, SVMW-1-2, SVMW-1-3, and SVMW-1-4 ranged from +0.01 to +0.1 inches of water. Relative subsurface pressures measured at SVMW-2-1, SVMW-2-2, SVMW-2-3, and SVMW-2-4 ranged from +0.02 to +0.09 inches of water.

Parallel purging activities were conducted, as per Months 1 and 2, at a flow rate of approximately 200 mL/min. A calibrated PID was used to monitor the subsurface air removed from each well port during purging. Seven purge volumes of subsurface air were removed from wells SVMW-1-1, SVMW-1-2, SVMW-1-3, SVMW-2-1, SVMW-2-2, and SVMW-2-3 prior to collecting soil vapor samples. The PID readings measured at each well during purging were 0.0 ppm, except at SVMW-1-1, which had a maximum PID reading of 2.4 ppm. AMEC Geomatrix purged three volumes of subsurface air from wells SVMW-1-4 and SVMW-2-4. The PID readings collected at these wells during purging were 0.0 ppm.

Eleven soil vapor samples were collected in certified clean 1-Liter SUMMA canisters provided by Transwest. The canisters were equipped with a flow-metering orifice certified at the desired sampling rate of 200 mL/min. Three of the eleven samples collected were for QA/QC, which included one duplicate sample from SVMW-1-3, an ambient/field blank, and an equipment blank.

AMEC Geomatrix submitted the soil vapor samples under chain-of-custody protocol to Transwest on June 21, 2007 for VOC analysis following EPA Test Method TO-15, including isobutylene as a TIC. Transwest subcontracted CAS to conduct the TO-15 analysis. Isobutylene (at a concentration of 100 ppm) was used as the tracer compound to detect leaks within the sampling train.

3.4 SUMP REMOVAL INVESTIGATION

The activities associated with the sump removal investigation included removal of sump SSG-15I, which was located on the west side of Building 1 (Figure 2), and characterization of the soil in the vicinity of the sump. SRP chose to remove the sump because it was no longer an active sump and it was unknown if the sump had received Site COCs. The sump was installed in approximately 1966 and was utilized as a sewer interceptor grease trap for the collection of oily waste from the Heavy Equipment Garage (Building 34). The heavy equipment garage operated in Building 34 from 1966 until approximately October of 1986.

On July 13, 2006, prior to the sump removal activities, SRP conducted the initial sampling activity, which included sampling of the fluids in SSG-15I. None of the Site COCs were detected in the sump liquid sample. 2-Chlorotoluene, 1,2-DCB, 1,3-DCB, 1,4-DCB, and 1,2,4-Trichlorobenzene (1,2,4-TCB) were detected in the sump liquid sample. Certified analytical laboratory results from Transwest for the liquid sump sample are presented in Appendix A of the *Sump Removal Work Plan* (Geomatrix, 2006c).

In order to appropriately closeout the sump, AMEC Geomatrix conducted the activities in accordance with AMEC Geomatrix's *Sump Removal Work Plan, Salt River Project's 16th Street Facility, Phoenix, Arizona* dated October 6, 2006 (Geomatrix, 2006c) which was approved by EPA on October 20, 2006 (EPA, 2006a). The sump removal tasks included:

- Liquid and sludge characterization within the sump for disposal;
- Visual inspection to check the integrity of the concrete sump for concrete characterization;

- Removal of the sump contents and clean-out of the sump via triple rinsing;
- Removal and disposal of sump SSG-15I;
- Soil excavation and collection of confirmation soil samples for analysis of VOCs from the area surrounding the sump;
- Removal of influent and effluent piping associated with the sump, and capping/plugging of the remaining piping;
- Backfill and compact the excavated areas;
- Comparison of soil sample concentrations to ADEQ residential soil remediation levels (R-SRLs) and non-residential soil remediation levels (NR-SRLs) (ADEQ, 2007); and,
- Comparison of soil sample results to the ADEQ Groundwater Protection Levels (GPLs) for each COCs (ADEQ, 1996).

AMEC Geomatrix conducted post sump removal sampling at SSG-15I on November 6, 2006. Environmental Response Incorporated of Phoenix, Arizona performed the excavation activities. Excavation equipment (backhoe and front-end loader) was decontaminated before they were mobilized to the Site. Soil sampling equipment (stainless steel sleeves and plastic caps) was decontaminated as discussed in above *Section 3.3.1.3*.

Soil samples were collected from the exposed sidewalls (four sidewalls) and one soil sample was collected from native soils beneath each of the concrete sump chambers (Figure 13). Each of the sidewall soil samples was collected at a depth of six feet bgs, which was located a foot below the piping on the east and north walls. Each of the bottom soil samples was collected at a depth of 12 feet bgs. No additional soil samples were collected beneath the sump as there was no evidence that the integrity of the sump had been compromised, and there were no areas of visible staining.

Soil samples were collected from native soils in the backhoe bucket by pushing clean stainless steel sleeves into the excavated soil. Soil samples collected for chemical analysis were preserved on-site through methanol extraction following EPA Method 5035 (ADEQ, 2000) prior to being submitted to laboratory for analysis using EPA Test Method 8260B. Seven soil samples were collected and preserved on-site and submitted to Transwest under standard chain-of-custody procedure.

Soil samples were monitored for organic vapors using a PID for screening VOCs. Table 12 includes the PID readings for soil samples monitored for organic vapors during the field activities. Field screening of the soil samples was performed as discussed in *Section 3.3.1.2*.

Details about the Sump Removal activities are reported in the *Final Sump Removal Report, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated April 9, 2007 (Geomatrix, 2007c). The *Final Sump Removal Report* was approved by EPA on June 4, 2007 (EPA, 2007c).

3.5 INDOOR AIR QUALITY

The IAQ sampling was conducted to evaluate the potential impact from the vapor intrusion pathway of selected compounds by collecting indoor, outdoor, and perimeter air samples in and around each of the three buildings (Building 1, 4, and 34). The air sampling results provided a data set that was used to provide a quantitative evaluation of the potential health risk to occupants of these buildings from selected VOCs, which might be migrating from the subsurface.

AMEC Geomatrix followed the sampling procedures described in the *Final Air Sampling Work Plan – Buildings 1, 4, and 34, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated August 17, 2006 (Geomatrix, 2006b). Sampling procedures and protocols were developed in general accordance with the California Environmental Protection Agency (Cal-EPA), Department of Toxic Substances Control (DTSC) interim final 2005 document *Guidance for the Evaluation and Migration of Subsurface Vapor Intrusion to Indoor Air* (Cal-EPA, 2005). The *Final Air Sampling Work Plan – Buildings 1, 4, and 34* (Geomatrix, 2006b) was approved by EPA on September 26, 2006 (EPA, 2006b).

3.5.1 Indoor Air Quality Sampling

Mr. Kim Worl, a Certified Industrial Hygienist (CIH) with AMEC Geomatrix, conducted a walk-through of Buildings 1, 4, and 34, and identified appropriate sampling locations within the areas of concern and suitable background and control locations. Each of the potential sampling locations was visually inspected for activities, circumstances, and/or chemical operations that could influence the integrity of the indoor air samples. In addition, the visual inspection assessed the overall integrity of the installed flooring, to the extent possible, to identify potential vapor migration pathways (e.g., conduit/piping transitions, cracks, etc.).

IAQ sampling was conducted twice, once during the winter on March 2, 2006 and the second time during the summer on September 27, 2006. The two sampling events allowed the IAQ to be evaluated with regard to the "stack effect," a temporal variation in air quality concentrations in the building that may be due to the variation in air flow from the subsurface when heating or air conditioning is operating.

The indoor air sampling locations were chosen because they were representative of the areas that are most likely to be either inhabited by workers or were representative of the overall building air. On March 2, 2006, a total of 22 samples were collected from the selected sampling locations (indoor air, outdoor air, and perimeter air). During the second phase of sampling for indoor air, sampling location SRP-19 was inaccessible, and therefore, an alternate location, SRP-23 was selected (Figure 14).

During the March 2 and September 27, 2006 sampling events, four samples were collected on the first floor and two samples were collected on the second floor of Building 1. During both sampling events, two samples were collected on the west side of the building, which was closest to the area where the greatest detections of COCs in the subsurface soil gas samples were observed (Geomatrix, 2006a). The SUMMA canisters were placed at heights relative to the breathing zone air. During the March 2, 2006 sampling event, a field blank sample (an unopened canister, QA/QC sample) was placed on the first floor of Building 1. During the September 27, 2006 sampling event, a field blank sample (QA/QC sample) was placed on the second floor of Building 1; along with two samples. Four SUMMA canisters were placed in Building 4 during the March 2 and September 27, 2006 sampling events; including the field blank sample. Four SUMMA canisters were placed in Building 34 during both sampling events; including a duplicate sample. Figure 14 shows the locations of the 44 SUMMA canisters that were placed at the Site during the March 2 and September 27, 2006 sampling events.

The air samples were collected at each of the sampling locations using evacuated, 6-Liter, polished stainless steel SUMMA canisters. Each of the SUMMA canisters and flow controllers were individually certified as clean (e.g., PCE concentrations below 0.01 ppbv) by the analytical laboratory, CAS, prior to use in the field. The laboratory calibrated flow controllers were connected to the SUMMA canisters to meter airflow into the canisters over the course of the approximate eight hour sampling period. Dedicated vacuum gauges were used to monitor the canister fill rates. The sample inlets were positioned approximately three to six feet above grade, with the exception of the rooftop sample locations. At the completion of the air sampling period, the final vacuum readings were recorded; the sample valves were closed, the flow controllers were removed, and the sample inlets were capped.

The indoor air samples were analyzed for a total of 21 chemicals. These include the 12 COCs and the following nine chemicals that were reported as detected at concentrations greater than the generic shallow soil gas screening levels provided in the *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (EPA, 2002), during the active soil gas sampling:

- Benzene
- 1,2,4-TCB
- 1,2,4-trimethylbenzene (1,2,4-TMB);
- 1,2-dichlorobenzene
- 1,3-dichlorobenzene
- 1,4-dichlorobenzene
- chlorobenzene
- EB
- chloroform

Additionally, the air samples were analyzed for the remaining Site COCs. Thus, a total of 21 chemicals were analyzed during IAQ sampling. At the completion of the sampling, the SUMMA canisters were sealed and hand delivered to Transwest. The SUMMA canisters were then shipped via overnight delivery to CAS in Simi Valley, California. The samples were analyzed in accordance with U.S. EPA Method TO-15 for VOCs using gas chromatography/mass spectrometry (GC/MS) in selective ion monitoring (SIM) mode for 20 of the 21 aforementioned VOCs. The 21st VOC, 1,2,4-TMB, was analyzed in accordance with EPA Test Method TO-15, not using the SIM mode.

3.5.2 Outdoor Air Sampling

Outdoor air samples included outdoor air intakes for the HVAC/Evaporative Cooling System (EVAP) air supply system, outdoor air boundary (of the building) samples, and perimeter air samples. In response to EPA's comment letter dated May 31, 2006 (EPA, 2006c), AMEC Geomatrix collected three additional ambient (background) air quality samples from off-site locations to evaluate ambient air quality during the September 27, 2006 sampling event.

3.5.2.1 Outdoor Air Intake Locations

At least one outdoor air sample was collected next to the representative air intakes for the HVAC/EVAP air supply system for each of the buildings during the March 2, 2006 sampling event. The HVAC/EVAP air intake samples for Buildings 1, 4, and 34 were SRP-05, SRP-04 and SRP-02, respectively. The HVAC/EVAP air supply systems were running in normal operational mode the day of sampling, except for Building 34, where the EVAP system was not in operation due to the cool outdoor temperature. Sampling in each of the HVAC/EVAP air sample canisters was initiated at least 30 minutes prior to the collection of the indoor air samples for that building.

During the September 27, 2006 sampling event, the HVAC/EVAP air intake samples for Buildings 1, 4, and 34 were SRP-39, SRP-28, and SRP-29, respectively. During this sampling event the HVAC/EVAP systems were running in Buildings 1 and 4. Building 34's EVAP was not in operation because the large roll-up bay doors were completely open.

3.5.2.2 Outdoor Air Boundary Locations

Five additional outdoor air samples were collected during the March 2, 2006 sampling event to provide for representative samples of ambient air near the boundary of the buildings of interest. The outdoor air samples for Building 1 were SRP-01, SRP-18, and SRP-20, a duplicate sample of SRP-18, and for Building 34 was SRP-03. For Building 4, SRP-04 served as the outdoor air sample and the HVAC air intake sample.

3.5.2.3 Perimeter Air Locations

No perimeter air samples were collected during the March 2, 2006 sampling event. Four perimeter samples were collected off-site during the September 27, 2006 sampling event, including one QA/QC sample. The perimeter air samples included SRP-41, SRP-42, SRP-43, and SRP-44 (duplicate of SRP-43) (Figure 14). These samples provided information concerning the local regional air quality.

3.6 GROUNDWATER QUALITY MONITORING

SRP conducted quarterly groundwater quality and groundwater level monitoring in the four monitor wells at and near the Site beginning in February 2001 until June 2004, and thereafter performed semi-annual monitoring. Groundwater samples were collected and analyzed for halogenated and aromatic hydrocarbons using EPA Test Method 601/602. The analysis includes 11 of the 12 COCs. 1,4-dioxane was not analyzed during the groundwater quality monitoring. Table 13 presents a summary of the analytical results of the COCs analyses. Figure 15 shows the spatial distribution of select COCs concentrations in the four monitor wells for June 2001 and September 2007.

The greatest measured COCs concentrations were detected in groundwater samples collected from monitor well 16ST-03, located adjacent to the north boundary of the Site, and generally cross-gradient to the Site. The greatest measured TCE, PCE, and 1,1-DCE concentrations detected in monitor well 16ST-03 were 5.2 µg/L, 1.3 µg/L, and 7.4 µg/L, respectively during the September 2001 sampling event (Table 13). Concentrations at or less than the reporting limit of 0.5 µg/L for all three of these compounds were detected in monitor well 16ST-03 from the December 2003 until September 2007 sampling events. COCs concentrations measured in monitor wells 16ST-02 and 16ST-04, located on the east and west property boundaries, respectively, have been slightly above, equal to, or below the laboratory reporting limits during the monitoring period from February 2001 to September 2001. COCs have not been detected at concentrations exceeding the reporting limits in monitor wells 16ST-02 and 16ST-04 since the September 2001 sampling event. COCs have not been detected at concentrations exceeding the reporting limits in monitor well 16ST-01 located south of the Site since sampling began in February 2001. COCs have not been detected at concentrations exceeding the reporting limits in monitor wells 16ST-01, 16ST-02, 16ST-03, and 16ST-04 since the March 2005 sampling event. SRP currently conducts semi-annual groundwater monitoring (water level measurements and water quality analyses) and these data are reported to EPA.

3.7 PHASE II SOIL INVESTIGATION

In order to calibrate the potential source concentrations for the VLEACH modeling, AMEC Geomatrix reviewed additional Site historical sampling data. As discussed in AMEC Geomatrix's letter *Phase II Remedial Investigation Approach, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated April 1, 2008 (Geomatrix, 2008a) and *Response to EPA Comments, dated April 22, 2008, concerning the Phase II Remedial Investigation Approach, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated May 15, 2008 (Geomatrix, 2008b), AMEC Geomatrix completed two additional soil borings in order to obtain soil COC data, which could be used to calibrate the VLEACH model. Data obtained from the Phase II soil sampling investigation were combined with the Phase I sampling data (Geomatrix, 2006a) to further estimate potential historical impacts of Site COCs to groundwater. The combined sampling data were used in the VLEACH model (Ravi and Johnson, 1997) for refining calibration in the fine-grained geologic unit and to predict the historic Site COC fluxes to groundwater, and in the Summer's model (EPA, 1996) to estimate the COC groundwater concentrations from the beginning of known chlorinated solvent use circa 1964 (specifically for PCE), through the end of 2007 (see *Section 7.0*).

On Thursday, June 5, 2008, two soil borings: SB-1 near drywell DW-4 (approximately 2 feet south of SVMW-1), and SB-2 near the sewer interceptor grease trap SSG-16I (approximately 7 feet north of SVMW-2) were completed (Figure 16). Soil samples from the soil borings SB-1 and SB-2 were collected using a direct-push drilling method. Each soil sample was analyzed for the following chemical and physical parameters:

- VOCs –EPA Test Method 8260B (direct purge low level);
- TOC – EPA Test Method 9060A Modified; and,
- Total Porosity

Eight soil samples were submitted to Test America, to be analyzed for VOCs and TOC under normal chain-of-custody procedure and to Terracon for total porosity.

4.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

Soil sampling at the Site was conducted in two separate field activities as discussed in following sections. IDW generated during these field activities were temporarily stored on-Site and were appropriately disposed off-Site as discussed below.

4.1 SOIL SAMPLING AT SOIL VAPOR MONITOR WELLS

During installation of the SVMWs, soil samples were collected at selected intervals for determination of soil physical properties. A total of seven samples were collected from both SVMW borings. All the soil samples were tested for moisture content, TOC concentration (which can influence the mobility of chemicals in the soil), grain size distribution (sieve analysis), and bulk density, which are the necessary input parameters for the groundwater modeling (*Section 7.0*).

4.1.1 Soil Characteristics at SVMW-1

AMEC Geomatrix collected soil samples during the drilling of the borehole for SVMW-1. One soil sample was collected at 7.5 feet bgs. In addition, samples were collected from the Salt River gravels at 12.5 feet bgs, at 50 feet bgs, and at 60 feet bgs. The laboratory analyzed a total of four soil samples for soil moisture content, TOC, sieve analysis, and bulk density. Table 14 tabulates physical characteristics of the soil samples collected from SVMW-1. The sieve analysis results are attached as Appendix B. The TOC for all soil samples collected at SVMW-1 were below the maximum detection limits (MDL) of 4, 900 and 5,000 milligram per kilogram (mg/kg).

4.1.2 Soil Characteristics at SVMW-2

AMEC Geomatrix collected soil samples during the drilling of the borehole for SVMW-2. One soil sample was collected from the fine-grained unit at 5 feet bgs. In addition, samples were collected from the Salt River gravels at 35 feet bgs and at 75 feet bgs. The laboratory analyzed a total of three soil samples for soil moisture content, TOC, grain size distribution (sieve analysis), and bulk density. Table 14 tabulates physical characteristics of the soil samples collected from SVMW-2. The sieve analysis results are attached as Appendix B. The sample collected at 5 feet bgs (shallow depth) had a TOC concentration of 5,600 mg/kg, while the rest of the samples were below the MDLs of 4,900 and 5,000 mg/kg.

4.2 Soil Sampling at Sump SSG-15I

Lithology of the soil around the sump SSG-15I consisted of a fine grain unit (Lean Clay [CL] and Silt [ML]) to approximately 10 feet bgs. A coarse grain unit, which consisted of Poorly Graded Sand with Gravel (SP) was encountered from approximately 10 feet bgs to the total depth of excavation (approximately 12 feet bgs). Based on the Site geology (*Section 2.1.8*), the lithology of the Site is similar to the soil encountered during sump removal investigation. Soil samples collected from the vicinity of the sump were analyzed for Site COCs. Analytical results of the soil sampling at sump SSG-15I are discussed in *Section 5.2*.

4.3 Investigation Derived Wastes

IDW were temporarily stored on-site in suitable containers (*i.e.,* 55-gallon drums or 30 cubic yard roll-off bins). Each container was clearly labeled as containing project derived waste that may contain hazardous substances, along with the date of collection, soil boring location number and approximate depth, and with language communicating that contents are drill cuttings and soils from Site investigation activities awaiting analytical results.

Decontamination rinse water and other aqueous residues were collected, contained, and labeled as containing project derived waste that may contain hazardous substances, along with the date of collection, location and nature of the material, and with language communicating that contents are liquids from Site investigation activities awaiting analytical results.

During sump removal activities, removal of the liquid from the sump, rinsing, decontamination, and soil excavation generated approximately 110-gallons of liquid and approximately 80 cubic yards of soil. The excavated soil was temporarily stored on-site in four 20 cubic yard roll-off bins, and liquid from the sump was stored in 55-gallon

drums. On November 16, 2006, SRP collected one soil sample from each roll-off bins (four) and composited them into one sample for waste characterization.

During SVMW installation activities, removal of decontamination water from the decontamination area and borehole drilling generated approximately 55-gallons of liquid and approximately 10 cubic yards of soil. SRP collected one soil sample on February 9, 2007 from the 20-cubic yard roll-off bin for waste characterization (Appendix C).

The soil samples from both events (Sump Removal and SVMW installation activities) were analyzed for toxicity characteristic leaching procedure (TCLP) VOCs using EPA Test Method 1311/ 8260B, eight Resource Conservation and Recovery Act (RCRA) metals following EPA Test Methods 6010B and 7471a (mercury). The excavated soils and soils from drilling activities were transported to Butterfield Landfill in Mobile, Arizona.

The liquid from the sump and decontamination activities was manifested as industrial non-hazardous waste and transported by Lassila Liquid Waste Disposal to Liquid Environmental Solutions of Arizona in Phoenix, Arizona. Butterfield Landfill and Liquid Environmental Solutions are both CERCLA and EPA approved off-site disposal facilities. The EPA Identification numbers for both facilities is provided below:

- Butterfield Landfill: EPA ID # AZD983481813
- Liquid Environmental Solutions: EPA ID # AZR000030452

Laboratory analytical reports for the waste soil samples and the waste manifests for the liquid and soil for Sump Removal activity are included in *Appendices C and D,* respectively*, of the Final Sump Removal Report* (Geomatrix, 2007c).

Laboratory analytical reports for the waste soil samples and the waste manifests for the liquid and soil for SVMW installation are included in Appendix C and D of this report, respectively.

5.0 NATURE AND EXTENT OF CONTAMINATION

This section discusses results of the Site characterization activities that were conducted at the Site.

5.1 PASSIVE AND ACTIVE SOIL GAS INVESTIGATION

The purpose of the passive soil gas survey was to screen for the presence of COCs near the sewer and storm drain piping in PSAs 1 and 2 and within PSAs 3 and 5, where COCs were reportedly stored. AMEC Geomatrix conducted a passive soil gas survey

using GORE-SORBER™ modules at 43 locations (Figure 9A). Sampling locations were chosen based upon the Site's historical COC handling, storage, and disposal as presented in the Research Report (SRP, 2004). 1,4-dioxane was not analyzed during the passive soil gas survey. The analytical testing was conducted by AEL.

The purpose of the active soil gas sampling was to evaluate potential releases of COCs to the soil through the Site sumps, interceptors, and drywells. AMEC Geomatrix conducted active soil gas sampling at 17 locations (Figure 9A). Active soil gas sampling was conducted below the base of the sumps/interceptors and drywell/drywell clusters. Based on historical SRP documents, it appears that the drywells were drilled to the top of the coarse-grained sediments. In addition to the 17 active soil gas samples collected below the base of the sumps/interceptors and drywell/drywell clusters, five shallow active soil gas samples were collected to provide comparison results to the passive soil gas data.

5.1.1 Passive Soil Gas Analytical Results

Table 15 shows the analytical results for the 11 COCs analyzed during the passive soil gas investigation (excluding 1,4-dioxane). PCE was the only Site COC detected above the laboratory MDL. PCE was detected above the MDL in 16 of the 43 passive soil gas samples analyzed (Table 15). The maximum detected mass of PCE was 0.49 micrograms (µg), which was observed in the sample location SG-18. The passive soil gas results indicated that minor releases of PCE may have occurred in the vicinity of PSA-1 and PSA-3. Slightly greater concentrations of PCE were detected in PSA-2C, specifically, the southern portion of Building 34. The passive soil gas data indicated the need for an additional investigation in the southern portion of Building 34. The passive soil gas data indicated that COCs were not present in PSA-2A, PSA-2B, PSA-4, and PSA-5.

5.1.2 Active Soil Gas Analytical Results

Tables 16A and Figure 17 provide the analytical results for the 12 COCs analyzed during the Phase I active soil gas sampling investigation conducted in November 2005. PCE, TCE, and 1,1,1-TCA were the only Site COCs detected in the active soil gas samples. The greatest concentration of PCE during the Phase I investigation was detected in soil gas sample ASG-5-12 at 9.70 µg/L (9,700 µg/m^3). The greatest concentration of TCE was detected in soil gas sample ASG-9-11 at 0 0.072 µg/L (72 µg/m^3). The greatest concentration of 1,1,1-TCA was detected in soil gas sample ASG-11-13 at 0.017 µg/L (17 µg/m^3) (Table 16A).

PCE was detected above the laboratory MDL in 24 of the 25 soil gas samples collected. Three of the soil gas samples collected were duplicate soil gas samples for QA/QC. Detected PCE concentrations ranged between 0.025 µg/L (25 µg/m^3) to 9.7 µg/L (9,700 µg/m^3). Five soil gas samples had PCE concentrations which exceeded 1 µg/L (1,000 µg/m^3) (Table 16A). The shallow soil gas sample collected from soil boring ASG-4 (ASG-4C-05) had a detected PCE concentration of 2.8 µg/L (2,800 µg/m^3). PCE was not detected above the laboratory MDL in shallow soil gas sample ASG-1C-05. However, the tracer compound (1,1-difluoroethane), used to assess air leakage from the ground surface, was detected in sample ASG-1C-05 (1,600 ppbv) and ASG-4C-05 (26,000 ppbv). The analytical results for ASG-4C-05 were interpreted to be adversely influenced by leakage of ambient air, and the results were qualified as rejected. However, using more recent EPA guidance documents (EPA, 2007d), the data usability was re-evaluated and are now flagged as estimated ("UJ" flags for the non-detects; "J" flags for the detects) in Table 16A.

The greatest detected concentrations of PCE were in the deep soil gas samples (10 to 12 feet bgs) collected from soil boring ASG-4-13.5, ASG-5-12, ASG-6-12, and ASG-9-11 at 1.4 µg/L (1,400 µg/m^3), 9.7 µg/L (9,700 µg/m^3), 2.4 µg/L (2,400 µg/m^3), and 4.3 µg/L (4,300 µg/m^3), respectively. These data indicate that PCE concentrations are greatest near sewer interceptor grease trap SSG-16I and/or drywell DW-3A/3B; sump SSG-15I; drywells DW-2B/2D, and drywell DW-4. Each of these structures is located in the southwest portion of the Site (Figure 7). The active soil gas data indicated that additional investigations should be performed in the southwestern portion of the Site to assess the vertical extent of PCE in soil gas and evaluate the potential to impact groundwater.

Table 16B and Figure 17 provide the results of the Phase II active soil gas investigation conducted in June 2006. Based on the deep soil gas analytical results from Phase I and Phase II active soil gas sampling, an approximate 1 µg/L (1,000 µg/m^3) contour was developed (Figure 17) near sewer interceptor grease trap SSG-16I and/or drywells DW-3A/3B; sump SSG-15I; drywells DW-2B/2D, and drywell DW-4 (southwest portion of the Site).

5.2 ANALYTICAL SOIL SAMPLING AT SUMP SSG-15I

AEL analyzed a total of seven soil samples for VOCs using EPA Test Method 8260B. Table 12 shows the COCs analytical results for the soil samples collected during the sump removal activities. The VOCs analyzed were all below the laboratory MDLs and the respective NR-SRLs and GPLs established by ADEQ (ADEQ, 2007) (Table 12). The VOCs were also below their respective R-SRLs. However, the laboratory MDL for VC was greater than the R-SRL for this compound.

5.3 MONTHLY SOIL VAPOR MONITOR WELL SAMPLE RESULTS

Table 17 presents the analytical results for the detected COCs analyzed during the monthly SVMW sampling activities. The samples were analyzed for VOCs by EPA Test Method TO-15, including 1,4-dioxane and 1,1-diflouroethane as TIC. PCE and TCE were the only Site COCs detected in the SVMW samples.

PCE was detected in soil vapor samples collected from all four depths in boring SVMW-1. The laboratory detected concentration ranges of PCE for the three sampling events were:

- SVMW-1-1 (screened interval – 82.5 to 83.5 feet bgs) – PCE concentrations ranged between 1.3 µg/L (1,300 µg/m^3) and 1.9 µg/L (1,900 µg/m^3)
- SVMW-1-2 (screened interval – 59 to 60 feet bgs) – PCE concentrations ranged between 0.79 µg/L (790 µg/m^3) and 0.94 µg/L (940 µg/m^3)
- SVMW-1-3 (screened interval – 32.5 to 33.5 feet bgs) – PCE concentrations ranged between 0.70 µg/L (700 µg/m^3) and 0.76 µg/L (760 µg/m^3)
- SVMW-1-4 (screened interval – 8 to 9 feet bgs) – PCE concentrations ranged between 4.0 µg/L (4,000 µg/m^3) and 7.5 µg/L (7,500 µg/m^3)

TCE was also detected in soil vapor samples collected from the four SVMWs in boring SVMW-1. The laboratory detected concentration ranges of TCE for the three sampling events were:

- SVMW-1-1 (screened interval – 82.5 to 83.5 feet bgs) – TCE concentrations ranged between 0.011 µg/L (11 µg/m^3) and 0.014 µg/L (14 µg/m^3)
- SVMW-1-2 (screened interval – 59 to 60 feet bgs) – TCE concentrations ranged between 0.048 µg/L (48 µg/m^3) and 0.063 µg/L (63 µg/m^3)
- SVMW-1-3 (screened interval – 32.5 to 33.5 feet bgs) – TCE concentrations ranged between 0.029 µg/L (29 µg/m^3) and 0.036 µg/L (36 µg/m^3)
- SVMW-1-4 (screened interval – 8 to 9 feet bgs) – TCE was only detected for the sample collected on June 20, 2007 at a concentration of 0.088 µg/L (88 µg/m^3)

PCE was detected in soil vapor samples collected from all four depths in boring SVMW-2. The laboratory detected concentration ranges of PCE for the three sampling events were:

- SVMW-2-1 (screened interval – 82 to 83 feet bgs) – PCE concentrations ranged between 1.7 µg/L (1,700 µg/m^3) and 2.0 µg/L (2,000 µg/m^3)
- SVMW-2-2 (screened interval – 59 to 60 feet bgs) – PCE concentrations ranged between 0.76 µg/L (760 µg/m^3) and 0.93 µg/L (930 µg/m^3)
- SVMW-2-3 (screened interval – 32.5 to 33.5 feet bgs) – PCE concentrations ranged between 0.67 µg/L (670 µg/m^3) and 1.1 µg/L (1,100 µg/m^3)
- SVMW-2-4 (screened interval – 8 to 9 feet bgs) – PCE concentrations ranged between 1.1 µg/L (1,100 µg/m^3) and 2.8 µg/L (2,800 µg/m^3)

TCE was detected in soil vapor samples collected from all four depths in boring SVMW-2. The laboratory detected concentration ranges of TCE for the three sampling events were:

- TCE was not detected in samples collected from SVMW-2-1 (screened interval – 82 to 83 feet bgs)
- TCE was only detected in SVMW-2-2 (screened interval – 59 to 60 feet bgs) on June 20, 2007 at a concentration of 0.0044 µg/L (4.4 µg/m^3)
- SVMW-2-3 (screened interval – 32.5 to 33.5 feet bgs) – TCE concentrations ranged between 0.0097 µg/L (9.7 µg/m^3) and 0.014 µg/L (14 µg/m^3)
- SVMW-2-4 (screened interval – 8 to 9 feet bgs) – TCE concentrations ranged between 0.015 µg/L (15 µg/m^3) and 0.056 µg/L (56 µg/m^3)

5.4 PHASE II SOIL SAMPLING RESULTS

AMEC Geomatrix submitted a total of eight soil samples to Test America for analysis on June 5, 2008. Two samples were collected from each soil boring, SB-1 and SB-2, with two encores for VOC analysis by EPA Test Method 8260B and two four ounce glass jars for TOC analysis by EPA Test Method 415.1 modified. Table 18 shows the soil sample analytical results, which are compared to ADEQ R-SRLs, NR-SRLs and GPLs (ADEQ, 2007). Table 19 shows the results for the physical parameters that were evaluated in samples from SB-1 and SB-2. Copies of the laboratory analytical reports are provided in Appendix E. Results from the additional soil sampling activities were utilized for calibration of the VLEACH model in the fine-grained unit.

PCE was detected in soil samples collected from SB-1-5.0 and SB1-11.0 at 1.8 µg/kg and 66 µg/kg, respectively; these concentrations are less than the R-SRLs, NR-SRLs and GPLs (Table 18). The additional VOCs analyzed were all below the laboratory MDLs and the respective NR-SRLs, R-SRLs and GPLs established by ADEQ (ADEQ, 2007).

6.0 DATA VALIDATION

AMEC Geomatrix performed data validation/verification of the laboratory data in accordance with the RI/FS Work Plan (Geomatrix, 2005b), and a summary is included in Appendix F.

7.0 PHASE I GROUNDWATER IMPACT MODELING

AMEC Geomatrix used the VLEACH (Ravi and Johnson, 1997) model and the Summer's model (EPA, 1996) to estimate the potential impact of Site COCs to groundwater in the Phase I modeling. AMEC Geomatrix used the VLEACH model and the soil vapor data collected during the three separate sampling events of the SVMWs to evaluate potential migration of PCE in soil gas to groundwater. TCE was not evaluated during the modeling effort since it was generally detected in the soil vapor samples at a fraction of the concentration of PCE (up to 100-times lower) (Table 17). The maximum flux rate calculated from the VLEACH model was then entered into a groundwater mixing model (Summer's model; EPA, 1996) to estimate the resultant groundwater concentration.

AMEC Geomatrix prepared a technical memorandum entitled *Technical Memorandum Regarding the Results of the Soil Vapor Monitor Well Sampling and Modeling Activities, Salt River Project's 16th Street Facility, Phoenix, Arizona,* dated September 26, 2007 (Geomatrix, 2007d) (Sampling and Modeling Memorandum). The aforementioned memorandum regarding the VLEACH and Summer's model was approved by EPA on December 4, 2007 (EPA, 2007e).

7.1 VLEACH MODEL

The VLEACH model (Version 2.2), which was developed for the EPA (Ravi and Johnson, 1997), describes the movement of an organic contaminant within and between three different phases: (1) as a solute dissolved in water, (2) as a gas in the vapor phase, and (3) as an adsorbed compound in the solid phase. VLEACH simulates vertical transport by advection in the liquid phase and by gaseous diffusion in the vapor phase. The VLEACH model predicts a mass flux of the chemical from the vadose zone

to groundwater over time. Conservative assumptions that reflect a homogeneous soil column from the surface to the groundwater table are used in the VLEACH model.

VLEACH is a one-dimensional finite difference vadose zone transport model that simulates the behavior of volatile chemicals in the soil vadose zone. A one-dimensional model implies that there is no lateral variation of soil or chemical parameters. The model is represented by a vertical stack of cells from the surface to the water table. The mass of the chemical within each cell is partitioned among three phases: liquid (aqueous), vapor, and sorbed to solid surfaces. The mass in each cell is calculated based on initial soil concentrations used as an input for a particular chemical modeled. Soil concentrations are converted into mass flux for the three phases and then summed as a total mass flux for each simulation cell gram per square feet per year (g/ft^2-yr). For simulation purposes, time is divided into discrete time steps. During each time step, chemical movement in soil occurs in the three separate phases. Equilibrium between the phases occurs according to the distribution coefficients used in the model.

In its current publicly accessible version (Version 2.2c; Harter, 2006), the VLEACH model is based on a number of major assumptions:

- Contaminant partitioning between phases follows linear relationships;
- The three phases present (liquid, vapor, sorbed) are in a state of equilibrium in each cell;
- Each chemical acts independently (i.e., mixtures do not affect equilibrium concentrations);
- The moisture content profile within the vadose zone is constant and the vadose zone is in a steady state with respect to downward water flux (recharge rate);
- Liquid-phase dispersion is neglected;
- No mobile phase non-aqueous phase liquid (NAPL) is present in the vadose zone;
- The vadose zone soil and the soil properties are completely homogeneous; and,
- The chemical concentration is not subject to natural degradation in soil.

7.1.1 VLEACH Modeling Data Requirements

The VLEACH model data requirements fall into four main categories:

- Chemical parameters - The parameters include the organic carbon distribution coefficient (K_{oc}), the Henry's Law constant (H´), the aqueous solubility, and the free air diffusion coefficient.

- Soil properties - The soil property data requirements include dry bulk density, total porosity, water-filled air porosity, and fraction of organic carbon.

- Site properties - The Site properties include recharge rate, depth to water table, chemical concentration in soil, and the area of the chemical source (described by a two-dimensional polygon).

- Model parameters - The model parameters include the computational time step length, simulation time, output intervals, cell thickness, and boundary conditions.

7.1.1.1 Chemical Parameters

Table 20 presents the chemical-specific parameters for PCE. The K_{oc} describes the partitioning of the contaminant with organic carbon. Henry's Law constant describes the liquid-gas partitioning of the contaminant. Water solubility describes the concentration of a contaminant that can dissolve in water. The free air diffusion coefficient describes the transfer of the contaminant due to Brownian motion in the air phase. These values were obtained from the *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*, revised February 22, 2004 and prepared by the EPA Office of Emergency and Remedial Response (EPA, 2004c) (EPA Guidance). Additionally, since the Phase I modeling was conducted, as presented in the Sampling and Modeling Memorandum (Geomatrix, 2007d), AMEC Geomatrix ran the Phase I modeling using the chemical parameters for PCE from the VLEACH manual (Ravi and Johnson, 1997) to be consistent with the modeling parameters used by other facilities within the OU3 study area. The VLEACH PCE chemical parameters are included on Table 20.

7.1.1.2 Soil Properties

The modeling simulations used two vertical soil profiles based on soil properties from varying sources. AMEC Geomatrix used this approach to provide a range of soil properties that may affect the predicted soil concentrations. The first set of soil properties for the vertical soil profile was based on a combination of Site-specific soil properties observed or measured during prior activities conducted at the Site and properties from EPA Guidance (EPA, 2004c). Measured Site-specific soil properties, such as bulk density and porosity, were limited to shallow soil (less than 10 feet bgs) and soil at a depth of

approximately 50 feet bgs. When Site-specific soil properties were not available for a range of depths, AMEC Geomatrix used values for the properties from EPA guidance (EPA, 2004c) for the soil types noted during well installation activities. Table 21 presents the soil properties used for this soil profile.

AMEC Geomatrix used a second estimated vertical soil profile in the VLEACH modeling based on soil properties obtained from EPA's *Soil Screening Guidance: Technical Background Document, Office of Solid Waste and Emergency Response, Washington D.C.*, dated 1996 (EPA, 1996) to evaluate for conservative soil properties. Table 21 includes the values for bulk density and porosity used from this source in the modeling. The soil parameters are not depth-specific.

The approximate depth to groundwater at the Site is 90 feet bgs; therefore, 90 feet of vadose zone soil was characterized.

7.1.1.3 Site Properties

Table 20 presents the values for the Site properties used in the VLEACH model and the sources for each value. As described in *Section 7.1.1*, the Site properties include recharge rate, depth to the water table, chemical concentration in soil, and the area of the chemical source. The recharge rate describes the velocity of water movement through the vadose zone. The VLEACH guidance (Ravi and Johnson, 1997) suggests using a range of possible recharge values because it is difficult to estimate this value. 15% of the annual local rainfall was used in VLEACH as the primary recharge rate. AMEC Geomatrix used a conservative estimate for the annual local rainfall of seven inches per year (in/yr) based on the ten year average annual rainfall for Phoenix, Arizona (National Weather Service, 2007). The corresponding infiltration rate of approximately one in/yr is a highly conservative rate compared to VLEACH modeling conducted at EPA Superfund sites in Arizona. A sensitivity analysis was also performed and is discussed in *Section 7.3*. The depth to the water table was modeled at 90 feet bgs.

The VLEACH model can evaluate up to three source areas as two-dimensional polygons. Figure 18 presents a conceptual representation of a source area modeled as a two-dimensional polygon (Ravi and Johnson, 1997). The potential Site sources modeled include: a drywell located near SVMW-1, a sewer interceptor grease trap (SSG-16I) located near SVMW-2, and a storm drain pipe that drains the sump to the drywell located near SVMW-1. Since the pipe drains the sump, AMEC Geomatrix conservatively estimated the drain pipe as a potential source. The drain pipe extends east from the sump for a distance of approximately 35 feet, then turns south and extends approximately 160

feet. The modeling assumes a pipe width of one foot. The conservatively estimated area of each source used in the modeling was:

- 25 square feet (ft^2) for the drywell based on a source area assumption of 5 feet by 5 feet;
- 50 ft^2 for the sump based on a source area assumption of 10 feet by 5 feet; and,
- 195 ft^2 for the drain pipe based on a source area assumption of 195 feet by 1 foot (assumes a cumulative area for the east-west section of the pipe and the north-south section of the pipe).

Figure 19 presents the approximate source areas modeled as separate two-dimensional polygons in the VLEACH model.

As mentioned in *Section 7.1*, the VLEACH model requires soil concentrations to estimate the chemical mass flux to groundwater. Since depth-specific soil vapor concentrations for the Site COCs were collected, the vadose zone soil concentrations were derived from soil vapor data using partitioning equations and the soil physical characteristics (both Site-specific and default as previously discussed). Table 22 presents the soil concentrations derived from the soil vapor concentrations and also presents the laboratory reported concentrations of PCE in soil gas over three separate sampling events from vapor ports in borings SVMW-1 and SVMW-2. As described in *Section 5.3*, PCE and TCE were both detected in the soil vapor; however, TCE was generally detected at a fraction of the concentration of PCE (up to 100-times lower). Therefore, only PCE was quantitatively evaluated for impact to groundwater.

Using equilibrium partitioning calculations, equivalent soil concentrations were estimated from maximum concentrations of PCE in soil gas over three sampling events from the SVMW ports in SVMW-1 (located near the drywell) and SVMW-2 (located near the sewer interceptor grease trap). Using both Site-specific and default soil physical properties, two sets of soil concentrations were estimated for each well (Table 23). The maximum of the calculated soil concentrations for each depth interval between the two SVMWs were used to provide conservative soil concentrations for use in modeling the drain pipe as a potential source area.

The three sets of soil concentrations estimated for use in the modeling (SVMW-1, SVMW-2, and Maximum) were based on the measured soil vapor data for four sampling depths. Chemical concentrations for the intervals between, above, and below the four sampling depths needed to be estimated. In order to provide representative PCE

concentrations across the entire 90-foot vadose zone, the following assumptions were made:

- The concentration at the shallowest depth measured (8.0-9.0 feet bgs) was conservatively extended to the soil surface;
- The average of measured concentrations were used to describe the intervals between measurements; and,
- The concentration at the deepest depth measured (82.5-83.5 feet bgs) was conservatively extended to the modeled water table at 90 feet bgs.

Table 22 summarizes the soil gas concentrations that were used to derive soil concentrations for use in the VLEACH model.

7.1.1.4 Model Parameters

The model parameters that affect performance of the calculations include: the computational time step length, simulation time, output intervals, cell thickness, and boundary conditions. Table 20 presents these parameters that are unique to the VLEACH model. The total simulation time and groundwater impact output intervals must be exact multiples of the time-steps. Small time steps, preferably less than a year, are generally recommended for the latest version of the model according to *Vadose Zone Leaching Model, Notes on Version 2.2b, Updated by Thomas Harter (Department of Land, Air, and Water Resources, University of California, Davis)*, dated June 29, 1998 (Harter, 1998). AMEC Geomatrix chose a model time step of 0.1 years for the VLEACH modeling, an output interval of one year, and 30 years as the total simulation time. The maximum predicted groundwater impact occurred within the first year. The vertical cell dimension used was one foot.

The upper boundary condition for vapor defines the contaminant concentration in the atmosphere above the soil surface. A negative value (-1.0) was used for the upper boundary, which models the polygon as impermeable to gas diffusion from the atmosphere. The lower boundary vapor condition was conservatively set to zero (0.0), which allows downward vapor diffusion into the saturated zone, when under normal conditions it would be impermeable to vapor.

7.1.2 VLEACH Modeling Results

The output of the VLEACH model consists of mass balance calculations, chemical mass flux rates at the land surface and water table, and groundwater impact estimates for each source area (or polygon). The mass balance calculations compare the change in mass within the profile to the calculated boundary fluxes. The surface flux rate calculations were

based on the upward flux at the surface due to gaseous diffusion. The groundwater impact calculations were based on the downward flux at the water table due to gaseous diffusion and liquid advection. Table 24 presents the estimated flux rates for model runs using the PCE chemical parameters from the EPA Guidance (EPA, 2004c) and from the VLEACH manual (Ravi and Johnson, 1997). The estimated flux for the drywell, the sewer interceptor grease trap, and the drain pipe using the EPA Guidance PCE parameters were 6.92×10^{-4}, 7.08×10^{-4}, and 8.96×10^{-4} g/ft^2-yr, respectively. Using the VLEACH PCE chemical parameters, the estimated flux rates for the drywell, the sewer interceptor grease trap, and the drain pipe were 7.62×10^{-4}, 7.72×10^{-4}, and 9.88×10^{-4} g/ft^2-yr, respectively. These VLEACH results are consistent for both PCE chemical parameter scenarios. The VLEACH input and output files for the Phase I modeling are included in Appendix G.1. AMEC Geomatrix conservatively assumed that PCE is present from 0 to 90 feet bgs for these models.

7.2 SUMMER'S MODEL

The Summer's model is an analytical model (EPA, 1996) based on conservation of mass and basic hydrology that calculates concentrations in groundwater assuming steady-state water movement and equilibrium partitioning of the chemical in the unsaturated zone and mixing in the underlying aquifer. The model assumes that the total mass discharged from the unsaturated vadose zone is completely mixed within the aquifer. For the saturated zone, the model assumes a constant flux from the source and mixing in the aquifer. Table 25 presents the assumptions and parameters used in the Summer's model.

7.2.1 Summer's Model Data Requirements

The data requirements for the Summer's model fall into two main categories:

- Groundwater aquifer properties – The groundwater aquifer properties include the mixing zone thickness, the hydraulic conductivity, and the hydraulic gradient. The hydraulic conductivity and gradient are used to obtain a groundwater velocity.

- Site properties – The Site properties required are the contaminant mass flux rate to groundwater, the area of each source, the infiltration rate, and the width of each source perpendicular to the groundwater flow direction.

7.2.1.1 Groundwater Aquifer Properties

The Summer's model defines the mixing zone thickness as the thickness of the aquifer. The ADEQ value of 10 meters (32.8 feet) was used for the aquifer thickness in this evaluation (ADEQ, 1996). AMEC Geomatrix conservatively used a hydraulic conductivity of 65,700 feet per year (ft/yr) based on the lower end of a range of hydraulic

conductivities (180 to 1,700 ft/day) for the Salt River gravels as discussed in the Shaw report *Final Groundwater Investigation Report* (Shaw, 2005). A hydraulic gradient of 0.001 was used in the Summer's model, which was calculated from the groundwater elevation levels measured in March 2007 presented in the Shaw report *Groundwater Monitoring Report for Motorola 52nd Street Superfund Site, Operable Unit 3 Study Area, Phoenix, Arizona* dated September 27, 2007 (Shaw, 2007). The groundwater velocity of 65.7 ft/yr was used in the Summer's model calculated as the product of the hydraulic conductivity and the hydraulic gradient.

7.2.1.2 Site Properties

The Summer's model used the contaminant mass flux rates to groundwater from the VLEACH model output files for each modeled source area. Table 24 presents the values used in the Summer's model for the mass flux rates. To correspond with the recharge rate used in the VLEACH modeling discussed in *Section 7.1.1.3*, AMEC Geomatrix used a conservative estimate of 15% of the local annual rainfall average of seven in/yr (National Weather Service, 2007), for the infiltration rate in the Summer's model.

The area of each source was used in the Summer's model. Based on a reported westward groundwater flow direction, the corresponding width of each source perpendicular to the flow was used in the model. A width perpendicular to groundwater flow of 160 feet was used for the drain pipe. AMEC Geomatrix used this value for the drain pipe based on the concept that the modeled pipe run, which has a total length of approximately 195 feet, only extends 160 feet perpendicular to groundwater flow.

7.2.2 Summer's Modeling Results

The mass flux entering groundwater calculated in the VLEACH model was converted into a groundwater concentration based on a series of equations and conversion factors. Table 24 presents the estimated maximum flux from leaching for the three potential source areas (the drywell, the sewer interceptor grease trap, and the drain pipe) and the predicted PCE concentrations in groundwater using PCE chemical parameters from both the EPA Guidance (EPA, 2004b) and the VLEACH manual (Ravi and Johnson, 1997). The estimated groundwater concentrations of PCE when using the EPA Guidance chemical parameters in the VLEACH model were 0.057, 0.116, and 0.018 µg/L for the drywell, the sump, and the drain pipe, respectively (Table 24). Using the PCE chemical parameters from the VLEACH manual, the estimated groundwater concentrations of PCE were 0.062, 0.127, and 0.020 µg/L, respectively (Table 24). The difference in the estimated groundwater concentrations using the PCE chemical parameters from the EPA Guidance (EPA, 2004c) and the VLEACH manual (Ravi and Johnson, 1997) was

less than 10%, indicating that the model is generally insensitive to the PCE chemical parameters.

Due to mixing and without the account for attenuation, the groundwater concentration resulting from the contribution of the three potential source areas is equal to the weighted average of the groundwater concentrations in individual areas. Each weight corresponds to the relative contribution from an individual potential source and will not be greater than 100%. Thus, to be conservative, AMEC Geomatrix assumed that the maximum resulting groundwater concentration is equal to the maximum of the groundwater concentrations in the three areas (i.e., 0.116 µg/L using the PCE chemical parameters from the EPA Guidance [EPA, 2004c] and 0.127 µg/L using the VLEACH manual PCE chemical parameters [Ravi and Johnson, 1997]). The estimated maximum groundwater concentrations of PCE using either source of PCE chemical parameters are approximately 25-times lower than the federal Maximum Contaminant Level (MCL) of 5 µg/L. The MCL is a drinking water standard promulgated by EPA and accepted by ADEQ. The fate and transport modeling results indicate that the PCE concentrations in the subsurface do not pose an unacceptable risk to drinking water.

7.3 SENSITIVITY ANALYSIS

As discussed previously in *Section 7.1.1*, EPA recommends estimating several recharge rates due to the potential for high uncertainty relating to this input parameter. As part of a sensitivity analysis, two alternate recharge rates were evaluated: 5% and 1% of the annual average rainfall. The difference between the resulting flux rates was less than 0.3% (Table 26), indicating that the recharge rate is not a sensitive parameter under the conditions evaluated for the Site. As per EPA's request in comment letter regarding *Technical Memorandum Regarding the Results of the Soil Vapor Monitor Well Sampling and Modeling Activities prepared by Geomatrix,* dated November 8, 2007 (EPA, 2007f), AMEC Geomatrix conducted the sensitivity analysis of porosity (Table 26), which indicated that the porosity is not a sensitive parameter under the conditions evaluated for the Site.

7.4 PHASE II GROUNDWATER MODELING

7.4.1 Purpose and Approach

AMEC Geomatrix previously used the VLEACH and Summer's models to estimate the potential impact of Site COCs to groundwater during the Phase I Remedial Investigation (*Sections 7.1 and 7.2*). AMEC Geomatrix collected soil vapor data during three monthly sampling events and used these results to calculate equivalent soil concentrations, which were then used as input to the VLEACH model to calculate PCE flux to groundwater. These results were then combined with conservative Site aquifer

parameters to calculate the estimated PCE concentration in groundwater using the Summer's model.

To evaluate if the Site has been a source to groundwater contamination associated with Site COCs, SRP conducted historical groundwater impact modeling using an approach similar to that applied at other facilities within the OU3 study area. To estimate possible historical groundwater impact, two stages of modeling were performed. The purpose of the Stage 1 modeling was to estimate theoretical historical soil concentrations based on the time periods that chlorinated solvents, specifically PCE, were used on Site (approximately 1964 through 1975). Historical soil concentrations were calibrated based on the results from previous soil gas sampling and soil sampling conducted as part of the Phase II Remedial Investigation activities (*Section 3.7*). The Stage 1 phase of the model is referred to as the calibration phase. Since soil vapor TCE concentrations were generally detected at concentrations that were a fraction of the PCE concentrations (up to 100-times lower), AMEC Geomatrix used only PCE data for the quantitative analysis. Additionally, the analytical results for the soil samples collected during the Phase II Remedial Investigation did not indicate the presence of other Site COCs (*Section 5.4*).

The purpose of the Stage 2 modeling was to predict the historic COCs' maximum flux to groundwater and associated groundwater concentrations. The calibrated source term concentrations were conservatively estimated to be released during the time period that chlorinated solvents were used on the Site. VLEACH was used to estimate the mass flux rate of Site COCs to groundwater. The mass flux rates were added in a concatenation file to estimate maximum flux rates, which were ran through the Summer's model to estimate a maximum groundwater concentration.

7.4.2 Site-Specific Stage I, Stage II, and Summer's Modeling

The VLEACH and Summer's model data requirements are discussed in *Sections 7.1 and 7.2*. Tables 27, 28, and 29 present the modeling parameters used for the Stage 1, Stage 2, and Summer's modeling approach, respectively. The tables include the following:

- the modeling parameters;
- the proposed value or range for the parameter; and,
- the rationale for the proposed value or range.

The chemical parameters for PCE were obtained from the VLEACH manual (Ravi and Johnson, 1997) to be consistent with the modeling parameters used by other facilities within the OU3 study area. The upper and lower boundaries for the Stage 1 and 2 modeling are presented in Tables 27 and 28, respectively. For the Stage 1 model, the lower boundaries were set at zero for the drywell and the sewer interceptor grease trap. This is considered to be a highly conservative approach for estimating groundwater flux since it overestimates vapor transport out of the bottom layer of the model. However, it is appropriate in the Stage 1 modeling because the true lower boundary of the shallow fine-grained unit modeled is more vadose zone soil with additional pore space available to vapors.

For the Stage 2 modeling, the saturated lower boundary at the water table is considered to be an impermeable boundary and therefore, the value is set at negative (-) 1.0. The potential for diffusion of volatile organic compounds downward from the vadose zone into the groundwater was studied by Weeks et al. (1982) using a finite difference model. Weeks' study demonstrated that it is reasonable to assume that the water table provides a complete barrier to fluorocarbon transport to the water table. In comparison to the fluorocarbons in the Weeks' study, PCE has a slightly lower free air diffusion coefficient (0.6 meters^2/day versus 0.8 meters^2/day), and therefore, the basis for the conclusions presented in the Weeks' study are applicable to the modeling conducted. The selection of an impermeable lower boundary is consistent with prior EPA applications of the VLEACH model. When VLEACH is operated in this manner, transfer of COCs from the base of the soil column to groundwater will be simulated by using liquid advection at the model recharge rate.

7.4.3 Stage 1 – Source Calibration

In order to calibrate the VLEACH model in the fine-grained unit, SRP completed two additional soil borings to an approximate depth of 13 feet bgs or refusal. The two soil borings were located near the sewer interceptor grease trap, SSG-16I (near SVMW-2) and the drywell, DW-4 (near SVMW-1). The locations of the two soil borings advanced as part of the Phase II Remedial Investigation (*Section 3.7*) are shown on Figure 16. The soil samples collected from each boring were based on the approximated depths of the sewer interceptor grease trap (approximately five feet bgs) and the base of the drywell (approximately 12 to 13 feet bgs).

The Stage 1 modeling was used to calculate the estimated initial soil concentrations for the drywell and the sewer interceptor grease trap during the time period that PCE was used on-Site. According to available historic usage information, PCE or PCE containing materials were used in the vicinity of these two features between 1964 and 1975. AMEC

Geomatrix used the VLEACH model to conduct Stage 1 modeling to calibrate potential source concentrations of PCE from the drywell (DW-4) located near SVMW-1 and the sewer interceptor grease trap (SSG-16I) located near SVMW-2 to recent and historic soil and soil vapor concentrations.

AMEC Geomatrix used the VLEACH model in an iterative fashion for the Stage 1 modeling by assuming initial concentrations of PCE as of 1975 for each of the potential sources and running the model through to the present. The results of each run (as presented on an annual basis from VLEACH output) were compared to available PCE soil and soil gas concentrations within the vicinity of SVMW-1 and SVMW-2. Specifically, measured depth-specific PCE concentrations in soil and soil gas were compared to the depth-specific output in the VLEACH contaminant concentration profile (.prf) file (Appendix G.2). The .prf file presents the predicted contaminant concentration in vapor, liquid, and solid phases at each time step requested (at one year intervals). The input and output files for the Stage 1 VLEACH modeling are included in Appendix G.

The results of the Stage 1 calibration modeling are presented in Table 30. The VLEACH model did not fully represent the soil and soil gas concentration profiles as indicated by laboratory results (see VLEACH .prf file in Appendix G.2). Therefore, AMEC Geomatrix calibrated the potential historical source concentration for the drywell to the laboratory detected PCE soil concentration of 66 μg/kg at a depth of approximately 11 feet bgs. The potential historic source concentration for the sewer interceptor grease trap was calibrated to the maximum soil vapor PCE concentration of 2.8 μg/L (2,800 $\mu g/m^3$) at a depth of approximately 8 to 9 feet bgs since the soil samples collected from the boring at depths of 5 and 13 feet bgs had PCE concentrations less than the laboratory detection limit. The calibrated source terms predicted by the Stage 1 modeling for the drywell and the sewer interceptor grease trap were 1,545 μg/kg and 42 μg/kg, respectively (Table 30 and VLEACH .prf file in Appendix G.2). The VLEACH input and output files for the Stage 1 modeling are also included in Appendix G.2.

AMEC Geomatrix also reviewed additional Site historical sampling data for use in calibrating the potential source concentrations during the Stage 1 modeling. Table 31 presents the historical data available for the calibration phase of the modeling. Based on the quality of the data available from historical sampling activities conducted at the Site and the approximate distance of the sample locations to the potential source areas, the Stage 1 modeling was primarily calibrated to the maximum concentrations of PCE in the shallow zone soil gas (within approximately 13 feet below bgs) from three sampling events conducted for SVMW-1 and SVMW-2 in 2007, and the analytical results for the shallow zone soil sampling conducted as part of the Phase II Remedial Investigation. A

comparison of the Stage 1 model output to the historical soil and soil vapor sample concentrations is included on Table 31.

7.4.4 Stage 2 - Historical Groundwater Impact Modeling

The calibrated potential source terms for the drywell and the sewer interceptor grease trap obtained from the Stage 1 modeling were used in the Stage 2 modeling. AMEC Geomatrix conservatively assumed the calibrated source concentrations from the Stage 1 modeling were consistent over the usage time period (1964 through1975) for PCE and PCE containing materials at the Site. The VLEACH model was used in the Stage 2 modeling by using the source terms from the Stage 1 modeling and the modeling parameters presented in Table 27 to calculate the PCE flux to groundwater for each source. The Stage 2 modeling parameters are presented in Table 28. AMEC Geomatrix estimated the PCE flux to groundwater for a depth to groundwater of 60 feet bgs and 90 feet bgs. The two scenarios were selected based on the approximate historic and current depths to groundwater within the vicinity of the Site. The VLEACH input and output files for the Stage 2 modeling are included in Appendix G.3.

The calculated flux rates for the Stage 2 VLEACH modeling were used as input to a concatenation file to determine the mass flux over the PCE usage time period. The Summer's model used the input parameters from Table 29 and the PCE concatenated flux rates to estimate the maximum PCE groundwater concentration for the two depth to groundwater scenarios (60 and 90 feet bgs). The aquifer thickness for the Summer's model was also varied. AMEC Geomatrix used the ADEQ default thickness of 32.8 feet; the approximate conservative historical thickness used by other sites within the OU3 area of 60 feet; and a conservative estimate of the aquifer thickness of 100 feet based on well log information in vicinity of site.

The maximum estimated groundwater concentrations of PCE for the two modeled depths to groundwater and the three aquifer thicknesses are presented in Table 32. The modeled groundwater concentrations of PCE ranged between 8×10^{-5} to 4×10^{-3} µg/L. The modeled groundwater concentrations based on the estimated historical impact are well below the federal MCL for PCE of 5 µg/L. The results of the Phase II groundwater modeling demonstrate that the historic potential for adverse groundwater impacts in excess of drinking water standards is very low based on the calibrated potential source concentrations of PCE.

7.4.5 Open Lower Boundary Condition for Stage 2 Modeling

AMEC Geomatrix ran the Stage 2 VLEACH model with the lower boundary condition set to zero (open boundary) for comparative purposes to the proposed modeling with the

lower boundary condition set to negative one (closed boundary). AMEC Geomatrix does not agree that running the Stage 2 VLEACH model with an open bottom boundary is appropriate because the water table is considered to be an impermeable boundary as demonstrated in the Weeks et al. (1982) study. In addition to the work conducted by Weeks in 1982, DiGiulio and Varadhan (2001), demonstrates that the contaminant transport through vapor/water exchange across the capillary fringe is a complex process. DiGiulio and Varadhan's research shows that the VLEACH results with an open boundary will not present a reasonable estimate of mass loading due to vapor transport to the groundwater table. Duke et al. (1998) showed that open lower boundary condition allows VLEACH to approximate upward diffusion into the soil column from the groundwater, which is not a realistic implementation of the conditions at the base of the column.

The Stage 2 VLEACH modeling with an open lower boundary condition was run for an approximate historical depth to groundwater of 60 feet bgs and an approximate current depth to groundwater of 90 feet bgs. The maximum summed PCE flux to groundwater for the groundwater depth of 60 feet bgs was 1.71×10^{-3} grams per square foot per liter (g/ft^2-L) and the PCE flux to groundwater for a modeled depth to groundwater of 90 feet bgs was 1.38×10^{-4} g/ft^2-L.

7.5 EPA REQUESTED GROUNDWATER MODELING

The EPA requested that additional groundwater modeling be conducted as described in EPA's comment letters dated November 25, 2008 and December 12, 2008, regarding the Final FRI Report (EPA 2008a and EPA 2008b). EPA requested groundwater modeling runs that includes scenarios for hypothetical spillage amounts; additional scenarios with an aquifer thickness of 10 feet for use in the Summer's model; and scenarios for Phase I and Phase II modeling with EPA specified input parameters. The following sections summarize the additional groundwater modeling.

7.5.1 Groundwater Modeling of Spillage Scenarios

EPA requested that hypothetical spillage scenarios be created to model the potential of historic COC impacts to groundwater. However, VLEACH does not start with a source term expressed as a volume of material released (e.g., gallons) or a rate of release (e.g., gallons per time period). Instead, soil VOC concentrations in a specified depth range of the vadose zone are used as an input to the VLEACH model. The Phase II groundwater modeling presented in *Section 7.4* uses an alternative approach to a volume of PCE spilled or released by calibrating historic source term soil concentrations of PCE for drywell DW-4 located near SVMW-1 and the sewer interceptor grease trap near SVMW-2 to known soil and/or soil gas concentrations. This approach was developed

since there is currently no known guidance for calculating release volumes into source term concentrations that can be used as input to the VLEACH model.

The calibrated source concentrations, calculated in the Stage 1 portion of the Phase II modeling (*Section 7.4.3*), were conservatively assumed to be released on an annual basis in the Stage 2 portion (*Section 7.4.4*) for the known time period when PCE or PCE containing materials were used on the Site. Bulk quantities (55-gallons) of PCE or PCE containing materials were used on the Site between 1964 through 1975 (SRP, 2004). The approximate historical PCE usages are summarized in Table 33. Where chemical usage indicated either 1,1,1-TCA or SS-25 (a PCE containing solvent material) was used, AMEC Geomatrix conservatively assumed that the entire amount was SS-25. The material safety data sheet for SS-25 (Appendix H) indicates the chemical contained approximately 35% PCE. The mass flux rates estimated for the Stage 2 modeling were then used as input to a concatenation file to determine the mass flux over the PCE usage time period (12 years) accounting for cumulative annual impacts.

Based on the conservative assumption that there was a release of PCE each year that PCE or PCE containing materials were used on the Site (a 12 year period), the resulting groundwater concentrations presented in Table 32 could be considered a "worst case" scenario since no evidence exists that there was a continuous release. However, to provide an even more conservative "worst case" scenario, AMEC Geomatrix re-ran Stage 2 of the Phase II modeling by increasing the calibrated source term concentrations from the Stage 1 modeling by 50%. AMEC Geomatrix used the Stage 2 modeling and Summer's model parameters presented in Tables 28 and 29 for this new scenario.

The PCE mass flux rates for a depth to groundwater of 60 feet bgs and 90 feet bgs were modeled using VLEACH with a closed lower boundary. VLEACH was not run with an open bottom boundary for this groundwater modeling since it is not technically appropriate because the water table is considered to be an impermeable boundary as previously discussed in *Section 7.4.5*. The VLEACH input and output files for this "worst case" scenario are included in Appendix I.1. The calculated flux rates from the VLEACH modeling were used as input into a concatenation file to determine a conservative cumulative mass flux rate over the known PCE usage period of 12 years. These flux rates were used with the Summer's model input parameters from Table 29 to estimate maximum PCE concentrations for the two depth to groundwater scenarios (60 and 90 feet bgs).

AMEC Geomatrix varied the aquifer thickness for the Summer's model using the ADEQ default thickness of 32.8 feet; the approximate conservative historical thickness used by other sites within the OU3 area of 60 feet; and a representative estimate of the aquifer thickness of 100 feet based on well log information available for wells within the vicinity of the Site. The maximum groundwater concentrations of PCE for the two modeled depths to groundwater and the three aquifer thicknesses are presented in Table 32 for this worst case scenario. The modeled worst case groundwater concentrations of PCE ranged between 1.2×10^{-4} to 6.3×10^{-3} µg/L. The modeled "worse case" groundwater concentrations are well below the federal MCL for PCE of 5 µg/L.

A "best case" scenario was also run by assuming the calibrated source concentrations from the Stage 1 modeling of the Phase II approach presented in Section 7.4.3 were only released during the original two years that PCE or PCE containing materials were used at the Site (1964 and 1965). The concatenation files for the Stage 2 modeling were modified to reflect a groundwater impact for two years of a modeled release instead of the original 12 years. The Stage 2 VLEACH modeling did not need to be re-run because the source term concentrations and resulting annual mass flux rates remain the same. Like the "worse case" scenario, the "best case" scenario was run for two depths to groundwater (60 and 90 feet bgs) and three mixing zone thicknesses (32.8, 60, and 100 feet). The maximum groundwater concentrations of PCE for the two modeled depths to groundwater and the three aquifer thicknesses are presented in Table 32 for this "best case" scenario. The modeled "best case" groundwater concentrations of PCE ranged between 1.9×10^{-5} to 8.8×10^{-4} µg/L. As with the historical (Phase II) modeling presented in *Section 7.4.4*, the modeled "best case" groundwater concentrations are well below the federal MCL for PCE of 5 µg/L.

Although there is not a direct methodology for calculating release volumes into source term concentrations usable for input to the VLEACH model, AMEC Geomatrix has used the following approach to generally correlate these values. The approximate annual total volume of PCE and PCE containing materials used in bulk Site-wide were summed and a corresponding monthly volumetric spill scenario of 1% was calculated (Table 33). The correlating mass of PCE released was partitioned between drywell DW-4 and sewer interceptor grease trap based on the ratio of the calibrated source term concentrations for the Phase II, Stage 1 modeling (*Section 7.4.3*). AMEC Geomatrix assumed that the mass of PCE released from each structure was uniformly distributed throughout a soil volume of 350 cubic feet (ft^3) for the sewer interceptor grease trap and 75 ft^3 for the drywell DW-4 (Table 33).

The resulting concentrations for the spillage scenario of 1% were then used as the source concentration in the Phase II, Stage 2 modeling approach (*Section 7.4.4*). AMEC Geomatrix used EPA requested chemical and soil input parameters presented in *Section 7.5.3* for this run. The revised Stage 2 model was run with a depth to groundwater of 60 feet bgs. The depth-specific output of the VLEACH modeling was compared to available PCE soil and soil gas concentrations within the vicinity of drywell DW-4 and sewer interceptor grease trap.

The output for the 1% spill scenario over predicts the known soil and soil gas concentrations in the vicinity of drywell DW-4 and the sewer interceptor grease trap. The predicted soil gas concentration at a depth of 8 feet bgs was between 328 μg/L (3.28×10^5 μg/m^3) and 2,569 μg/L (2.569×10^6 μg/m^3) for the sewer interceptor grease trap compared to a measured maximum value from the three months of soil vapor sampling of SVMW-2 (*Section 5.3*) of 2.8 μg/L (2,800 μg/m^3). The results of the Phase II soil sampling (*Section 5.4*) indicate PCE soil concentrations near the sewer interceptor grease trap were less than the laboratory detection limits 2.0 μg/kg and 9.7 μg/kg for samples collected at depths of 5 and 13 feet bgs, respectively. The predicted soil concentrations from the VLEACH output files for the 1% spill scenario at these depths were between 226 μg/kg and 1,846 μg/kg.

The maximum soil gas concentration of measurements from SVMW-1 at a depth of 8 feet bgs was 7.5 μg/L (7,500 μg/m^3) (*Section 5.3*), while the VLEACH model for the 1% spill scenario predicts concentrations between 1,807 μg/L (1.807×10^6 μg/m^3) and 16,180 μg/L (1.618×10^7 μg/m^3). The results of the Phase II soil sampling (*Section 5.4*) indicate PCE soil concentrations near drywell DW-4 at depths of 5 and 11 feet bgs were 1.8 μg/kg and 66 μg/kg, respectively. The predicted soil concentrations from the VLEACH output files for the 1% spill scenario at these depths were between 796 μg/kg and 15,053 μg/kg. The results of the VLEACH modeling for this scenario indicates that the mass predicted by assuming a 1% volumetric release is inappropriate because it drastically over predicts known soil and soil gas concentrations.

Furthermore, records indicate that the amount of PCE or PCE containing materials used in bulk on the Site that could have had the potential to impact drywell DW-4 or the sewer interceptor grease trap were located within Building 3 (Electric Shop) (SRP, 2004). Also, usage of bulk solvents containing PCE at the Site was reduced significantly, or even ended altogether, after the mid-1970s as follows:

- The electric shop (at Building 3) vacated the Site in 1974.

- The transportation operations at the Site were subcontracted, beginning in mid-1970s.

Active soil gas data indicated that PCE concentrations were greatest near sewer interceptor grease trap SSG-16I and/or drywell DW-3A/3B, and drywell DW-4 (Building 3). This would further reduce the potential amount of spillage compared to the 1% spill scenario previously described, which conservatively assumed all PCE or PCE containing materials used in bulk could have potentially impacted the features.

The results of the revised groundwater modeling for the two spill scenarios support the fact that the historic potential for adverse groundwater impacts in excess of drinking water standards is low. This is based on using greater source concentrations of PCE for the spill scenarios than the source concentrations calibrated to Site soil and soil gas data as presented in the Phase II, Stage 2 groundwater modeling (*Section 7.4.4*).

7.5.2 Groundwater Modeling with an Aquifer Thickness of 10 Feet

EPA requested that the Phase I and Phase II models be re-run with an aquifer thickness of 10 feet for the Summer's model. The EPA referenced two papers (Clausen et al., 2003 and Brannaka et al., 1998) as support for the request of a reduced aquifer thickness in correspondence. The Clausen et al. paper briefly discusses the use of the Summer's model, but focuses on a discussion of the general input parameters used in the model and not specific values used for the input parameters. The paper does not mention the use of a 10 foot mixing zone thickness.

The EPA referenced paper by Brannaka et al. discusses the general approach that some state level regulatory agencies used to establish soil cleanup standards based on groundwater leachate modeling. The paper focuses on the general approach taken by the New Hampshire Department of Environmental Services. The approach discusses the development of a generic release representative of "the geology of the regulated region". The modeling was carried through to find a maximum contaminant concentration in soil moisture at the soil/water table interface. The Brannaka et al. paper does not discuss specific values used for a mixing zone thickness.

AMEC Geomatrix conducted a review of available well information within an approximate one-mile radius of the Site. The screened intervals for wells within this radius ranged from approximately 40 to 214 feet. Based on this information, and the ADEQ's default mixing zone thickness of 10 meters, a 10 foot mixing zone thickness would not be an appropriate representation for calculating concentrations of PCE in groundwater. However, at EPA's request, AMEC Geomatrix re-ran the Phase I and Phase II models with a mixing zone thickness of 10 feet. All other modeling parameters remained the

same as discussed in Sections 7.2 and 7.4. The maximum predicted PCE groundwater concentrations using a 10 foot thick mixing zone for the Phase I and Phase II models are presented in Table 24 and Table 32, respectively. The estimated maximum PCE groundwater concentrations for the Phase I and Phase II models with the revised mixing zone thickness of 10 feet are well below the federal MCL for PCE of 5 µg/L. The corresponding modeling files are included in the attached Appendix I.2.

7.5.3 Groundwater Modeling using EPA Requested Input Parameters

EPA requested that the Phase I and Phase II models be run with the following input parameters:

- *Water solubility - 150 mg/L*
- *Koc - 660 ml/g*
- *Henry's Law constant - 0.92*
- *Bulk density – 1.65 g/ml*
- *Foc – 0.001*
- *Recharge rate – 0.0083 ft/yr*

These model scenarios were run using a one square foot polygon area for VLEACH and a vertical cell thickness of one foot with 120 cells (a depth to groundwater of 60 feet bgs) at the request of EPA. The requested scenarios were also run with a maximum soil vapor concentration of 9.7 µg/L (9,700 µg/m^3).

The Phase I model was run with an equivalent soil concentration calculated using the partitioning equations presented in Tables 22a and 23a, and the soil gas concentration of 9.7 µg/L (9,700 µg/m^3) for drywell DW-4 located near SVMW-1. The source term concentrations for the sewer interceptor grease trap located near SVMW-2 and the conservatively modeled drain pipe connecting remained the same as presented in Table 23. These source term concentrations were not modified as the sample containing the soil gas concentration of 9.7 µg/L (9,700 µg/m^3) was located near drywell DW-4. The revised Phase I modeling files are included in Appendix I.3. The estimated groundwater concentrations of PCE for drywell DW-4, the sewer interceptor grease trap, and the drain pipe using EPA's requested parameters were 0.271, 0.244, and 0.068 µg/L, respectively (Table 24). To be conservative, AMEC Geomatrix assumed that the maximum resulting groundwater concentration is equal to the maximum of the groundwater concentrations in the three areas (i.e., 0.271 µg/L). The resulting maximum PCE groundwater concentration for the re-run Phase I model is well below the federal MCL of 5 µg/L.

The Phase II model was run with the requested changes in the soil and chemical parameters. A revised source term concentration for drywell DW-4 was calculated in the Stage 1 modeling by calibrating the source concentration to the soil gas concentration of

9.7 µg/L (9,700 µg/m^3) in a similar fashion as presented in *Section 7.4.3* (Table 30a). The revised drywell source concentration was then used in the EPA requested Stage 2 modeling to estimate a maximum groundwater concentration. The source concentration for the sewer interceptor grease trap remained the same as in the Stage 2 modeling presented in *Section 7.4.4* since the soil gas concentration of 9.7 µg/L (9,700 µg/m^3) was for a sample collected in the vicinity of drywell DW-4 and not the sewer interceptor. This Stage 2 modeling was run with a closed lower boundary layer. VLEACH was not ran with an open bottom boundary for this groundwater modeling since it is not appropriate because the water table is considered to be an impermeable boundary as previously discussed in *Section 7.4.5*. The estimated maximum PCE groundwater concentration using the EPA requested parameters is 1.20 µg/L (Table 32). The estimated PCE groundwater concentration is below the federal MCL of 5 µg/L. The revised Phase II modeling files are included in the attached Appendix I.3.

8.0 BASELINE RISK ASSESSMENT

The risks involved with the COCs on Site were evaluated through Ecological Risk Assessment (ERA) and Human Health Risk Assessment (HHRA). Following section discusses the results of the ERA and HHRA conducted for the Site.

8.1 ECOLOGICAL RISK ASSESSMENT

As presented in the Research Report (SRP, 2004) and in *Section 2.1.5*, the results of the ERA for the Site, which was performed by SRP, indicated that no significant ecological risks exist at the Site.

8.2 HUMAN HEALTH RISK ASSESSMENT

For the HHRA, the IAQ sampling was conducted at the Site to evaluate the potential health risks to occupants of Buildings - 1, 4, and 34 associated with the Site-related chemicals measured in indoor air. The potential public health impacts associated with measured levels of Site-related chemicals in air were evaluated by comparison to three tiers of screening levels and/or data, and by analysis using the Johnson and Ettinger (J&E) model (Johnson and Ettinger, 1991). The three tiers and J&E model are briefly described below:

- Tier 1: Site indoor air concentrations were compared to Occupational Safety and Health Administration (OSHA) permissible exposure levels (PELs).

- Tier 2: Site indoor air concentrations were compared to outdoor air concentrations (to put the Site concentrations into proper context). As part of the Tier 2 evaluation of the data collected, measured levels of

chemicals in indoor air were compared to chemical concentrations measured in outdoor perimeter and HVAC intake samples, to assess whether indoor air concentrations were greater than perimeter samples.

- Tier 3: Site indoor air concentrations were compared to EPA's target indoor air concentrations published in the *Draft Subsurface Vapor Intrusion Guidance* (EPA, 2002) with the exception of TCE. As directed by U.S. EPA, the California Human Health Screening Level (CHHSL) was used for comparison.

- EPA's J&E Model for Subsurface Vapor Intrusion into Buildings: J&E model was run using soil gas data to evaluate the potential human health risks in indoor air.

AMEC Geomatrix prepared the report titled *Final Indoor Air Quality Report, Salt River Project's 16th Street Facility, Phoenix, Arizona*, dated March 30, 2007 (Geomatrix, 2007e), which presents the procedure for IAQ sampling, results of the IAQ sampling (including laboratory analytical data), associated activities, and conclusions. EPA approved AMEC Geomatrix's Final Indoor Air Quality report on May 4, 2007 (EPA, 2007g).

8.2.1 Chemicals Detected in Each Media

Table 34 provides a list of the Site COCs and the 11 chemicals that were detected above the shallow generic soil gas screening levels provided in EPA's 2002 document "*Draft Subsurface Vapor Intrusion Guidance*". Table 34 lists the chemical name and the sample media with a yes or no response for each chemical evaluated and the range of laboratory reported concentrations. The various media evaluated included: active soil gas samples, outdoor on-Site air samples, perimeter air samples, and indoor air samples. Table 34 indicates that PCE, TCE, 1,2,4-TMB, 1,4-DCB, EB, and benzene were detected in each media sampled on site.

8.2.2 Soil Gas Modeling

J&E (Johnson and Ettinger, 1991) introduced a screening-level model that incorporated both convective and diffusive mechanisms for estimating the transport of contaminant vapors emanating from either subsurface soils or groundwater into indoor spaces located directly above the source of contamination. Per EPA's request in the May 31, 2006 comment letter (EPA, 2006c), the J&E model (version 3.1, EPA 2004c) was used to evaluate the potential human health risks in indoor air. Key assumptions in the model are as follows:

- Default soil properties for sand were used as the input parameters for the J&E model.

- Two data sets were evaluated: 1) soil gas data excluding samples that were originally rejected based on elevated concentrations of the leak detection compound and 2) all soil gas data. ASG-1C and ASG-4C soil gas results were originally rejected based on the presence of elevated concentrations of the leak detection compound in these samples. Current evaluation criteria (EPA, 2007d) would categorize ASG-4C as J flagged and the data would be identified as "estimated". ASG-1C results would be categorized as valid data. Appendix J.1 through J.5 includes the qualified analytical reports.

- The size of the smallest building among the three evaluated was conservatively used to represent the building size.

Additional input parameters for the model were based on default and/or conservative Site-specific assumptions.

Table 35 presents the predicted incremental carcinogenic risk and noncancer hazard indexes calculated using the J&E model for both soil gas data sets. The data and calculations for the J&E model are included in *Appendix C of IAQ Report* (Geomatrix, 2007e). Two sets of results are shown in Table 35 for PCE and TCE because two different sets of toxicity criteria were used to evaluate these chemicals. Initially, provisional toxicity criteria published by EPA (included with EPA's spreadsheet version of the J&E Model) were used. Subsequently, the modeling was also run using toxicity criteria published by the Cal-EPA as recommended by EPA (EPA, 2007h). For PCE, the incremental cancer risk remained the same for PCE, but the hazard index went up. For TCE the incremental cancer risk and the hazard quotient went down.

The overall potential lifetime excess cancer risk based on the maximum concentrations in soil gas for either data set was 8.8×10^{-6} using EPA toxicity criteria for PCE and TCE and 6.0×10^{-6} using Cal-EPA toxicity criteria for PCE and TCE; these results are within acceptable carcinogenic risk range of 1×10^{-6} to 1×10^{-4} (EPA, 1990a and 1990b).

The potential hazard index based on the maximum concentrations in soil gas was 1.8 for the data set excluding the originally rejected values using both EPA and Cal-EPA toxicity criteria. When the data set includes the two flagged data points, the potential hazard index is 36. It should be noted that hazard indices greater than 1 do not necessarily mean that adverse health effects will be observed. The potential hazard indices, which are greater than the acceptable hazard index of one, resulted from concentrations of 1,2,4-TCB. The greatest concentrations of 1,2,4-TCB in soil gas were 900 μg/L (900,000 $\mu g/m^3$) and 44 μg/L (44,000 $\mu g/m^3$) in two active soil gas locations. The next greatest

concentration in soil gas was 2.3 μg/L (2,300 μg/m^3), which corresponds to a hazard quotient of 0.09. All other detections of 1,2,4-TCB in soil gas were substantially lower and, therefore, would result in a hazard index significantly less than 1. Also, 1,2,4-TCB was not measured in indoor air samples. Thus, the 1,2,4-TCB measured in soil gas is not considered to present an issue in indoor air. The individual hazard quotients and cumulative hazard index for all other chemicals were less than 1, which would indicate that the noncancer health effects from exposure to these chemicals is not likely.

8.2.3 Human Health Risk Assessment Results

The chemicals detected in the indoor, outdoor, and perimeter air samples were significantly below the Tier 1 criteria (worker exposures), which included the permissible exposure levels (PELs) and American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Value (TLVs) (Table 36). SRP has a hazard communication program in place at the Site to make workers aware of their potential exposure to chemicals.

The indoor air concentrations for the majority of the chemicals detected were approximately within a factor of five of the outdoor and perimeter air concentrations (Tier 2), except for 1,1-DCE, 1,1,1-TCA, 1,2,4 TMB, and EB at certain building locations. The potential cumulative cancer risk for all chemicals detected was approximately 1×10^{-5} to 2×10^{-5} for both sampling events (Table 37), which is within EPA's acceptable risk range of 1×10^{-6} to 1×10^{-4} (EPA, 1990a and EPA, 1990b). The hazard index was less than 1 (EPA, 1989).

9.0 COMMUNITY INVOLVEMENT

As presented in the AOC, the development and implementation of community involvement activities for the Site investigation are the responsibility of EPA. The critical community involvement planning steps performed by EPA included conducting community interviews and development of a Community Advisory Group (CAG), which conducts regular meetings. Although implementation was the responsibility of the EPA, SRP assisted in the process by preparing presentations regarding the Site's history, RI updates, and participating in public meetings. SRP also has a hazard communication program in place at the Site to inform workers of their potential exposure to chemicals and to keep them apprised of the results of Site environmental activities.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Pursuant to the AOC (EPA, 2004), SRP has performed the focused RI/FS investigation at the Site. The investigation activities included: passive and active soil gas sampling,

soil sampling, vadose zone sampling, groundwater impact modeling, and indoor, outdoor and perimeter air sampling. In addition, SRP also removed sump SSG-15I. A summary of the results for aforementioned sampling activities is presented below:

- Passive Soil Gas Sampling: On completion of the passive soil gas sampling, it was determined that COCs were not present in PSA-2A, PSA-2B, PSA-4, and PSA-5.

- Active Soil Gas Sampling: Detected PCE concentrations ranged from 0.025 µg/L (25 µg/m^3) in ASG-27-5 to 9.7 µg/L (9,700 µg/m^3) in ASG-5-12. The active soil gas data indicated that PCE concentrations were elevated near sewer interceptor grease trap SSG-16I and/or drywells DW-3A/3B; sump SSG-15I; drywells DW-2B/2D, and drywell DW-4 (southwest portion of the Site). An approximate 1 µg/L (1,000 µg/m^3) contour was developed for this area.

- Passive and Active Soil Gas Sampling: The results from the passive soil gas sampling indicated that PCE was present in PSA-1, PSA-2C, and PSA-3. Active soil gas samples were collected in the areas near the base of sumps/interceptors and drywells/drywell clusters. Additional active soil gas samples were also collected in the aforementioned PSAs based on the initial passive and active soil gas sampling results.

- Removal of Sump SSG-15I and Soil Sampling: SRP removed Sump SSG-15I and performed soil sampling beneath and around the four walls of the sump. Results of soil samples collected during the removal of sump were all below the MDL (500 µg/kg or less) for the Site COCs. The MDLs for the Site COCs were 500 µg/kg or less, which is below the GPL, established by the ADEQ for those compounds that have an established GPL.

- Soil Vapor Monitoring: The soil vapor monitor well data indicate that the concentration of PCE in soil vapor ranged from 0.67 µg/L (670 µg/m^3) in SVMW-2-3 to 7.5 µg/L (7,500 µg/m^3) in SVMW-1-4. The laboratory detected TCE concentrations ranged from 0.0044 µg/L (4.4 µg/m^3) in SVMW-2-2 to 0.088 µg/L (88 µg/m^3) in SVMW-1-4. These low concentrations of PCE and TCE in the soil vapor samples indicate that there are minor residual concentrations of these two Site COCs in the soil vapor.

- Indoor Air Quality Sampling: In summary, all of the chemicals detected were significantly below the Tier 1 criteria (worker exposure), which included the PELs and TLVs. The indoor air concentrations for the chemicals detected were within a factor of five of the outdoor air concentrations, except for 1,1,1-DCE, 1,1,1-TCA, 1,2,4-TMB, and EB. However, the detections of 1,1,1-DCE, 1,1,1-TCA, and 1,2,4-TMB in indoor air were below their residential screening criteria and individually were below the target hazard quotient of 1.0. In addition, the removal of

sump SSG-15I has further reduced the potential for VOC volatilization to indoor air.

- Johnson and Ettinger Model: The overall potential lifetime excess cancer risk based on the maximum concentrations in soil gas for either data set was 8.8×10^{-6} using U.S. EPA toxicity criteria for PCE and TCE and 6.0×10^{-6} using California Environmental Protection Agency (Cal-EPA) toxicity criteria for PCE and TCE; these results are within acceptable carcinogenic risk range of 1×10^{-6} to 1×10^{-4}. Therefore, the results of this indoor and outdoor air evaluation, and the J&E model results for soil gas indicate that no further indoor air sampling, indoor remedial action, or sub slab sampling are required at the Site.

- Groundwater Impact Modeling: The results of the VLEACH and Summer's model demonstrate that the potential for adverse groundwater impacts in excess of drinking water standards is very low based on the soil vapor concentrations of PCE that have been detected at the Site. The predicted total PCE concentration in groundwater from the three potential source areas due to leaching is 0.19 µg/L, which is approximately 25-times lower than the federal MCL of 5 µg/L. TCE was also detected in the soil vapor monitor wells. The reported concentrations were approximately 100-times lower than PCE, and since PCE and TCE have the same MCL of 5 µg/L, a quantitative analysis of TCE groundwater impacts would be insignificant.

- In addition, SRP conducted historical groundwater impact modeling. The results of this modeling effort demonstrated that the modeled groundwater concentrations of PCE ranged between 8×10^{-5} to 0.004 µg/L. The modeled groundwater concentrations based on the estimated historical impact are several orders of magnitude less than the federal MCL for PCE of 5 µg/L. The results of the Phase II groundwater modeling demonstrate that the historic potential for adverse groundwater impacts is negligible.

- Additional groundwater modeling scenarios were performed as requested by EPA. The results of the additional groundwater modeling showed that the potential impact of PCE to groundwater was below the federal MCL for PCE of 5 µg/L.

- The modeling results indicate that the Site does not pose an impact to groundwater that would result in an exceedance of the federal MCL for the Site COCs. Therefore, it is not technically justified for SRP to install a nested groundwater monitor well, to perform groundwater monitoring of the four monitor wells at or near the Site, or perform further remedial actions at the Site.

Based on an evaluation of the preliminary RAOs for the Site, as described in Technical Memorandum (Geomatrix, 2005a), the Site does not represent a threat to human health

and/or the environment due to the Site COCs. Consequently, it is not necessary to perform a feasibility study for the Site.

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TABLES

TABLE 1
EVENT CHRONOLOGY
Salt River Project's 16th Street Facility
Phoenix, Arizona

Date	Activity
1988	October - Arizona Department of Environmental Quality (ADEQ) identifies Salt River Project's (SRP) 16th Street Facility as potential source of groundwater contamination in Eastlake Park area.
1989	SRP responds to ADEQ's Request for Information on SRP facilities located within Eastlake Park Water Quality Assurance Revolving Fund (WQARF) area.
	June - SRP completes field investigation activities at 16th Street Facility.
	SRP provides a detailed response to ADEQ relative to the Eastlake Park investigation.
1990	May - A soil investigation is performed to evaluate an apparent release from suspected abandoned underground piping.
	June - SRP initiates a survey to identify all drywells in response to an ADEQ mandate.
1991	A drywell near the south end of the Heavy Equipment Garage is sampled.
	Catch basins and manholes at the 16th Street Facility are investigated to identify possible drywells.
1992	SRP completes an inventory of drainage features at the 16th Street Facility, two confirmed and six suspected drywells identified.
	September - ADEQ/Environmental Protection Agency (EPA) request completion of a questionnaire.
	November - SRP submits requested ADEQ/EPA questionnaire.
	November - SRP provides results of drywell sampling near the south end of the Heavy Equipment Garage to ADEQ.
1998	January - A Phase I Environmental Site Assessment of the 16th Street Facility is performed by SRP.
	Eight possible or confirmed drywells are identified at the 16th Street Facility.
2000	July - EPA requests information regarding the 16th Street Facility under Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Section 104 (e).
	September - SRP provides response to CERCLA Section 104 (e) information request.
2001	January - Four monitor wells are installed on and adjacent to the 16th Street Facility and quarterly monitoring commences.
2002	September - A soil vapor survey is performed at the 16th Street Facility.
2003	March - Receipt of EPA's General Notice Letter.
	September - SRP responded to EPA's General Notice letter.
2004	June - Effective date of Administrative Order of Consent, June 2.
	August - Remedial Action Objectives Technical Memorandum prepared by Hydro Geo Chem, Inc.
	August - Draft Research Report submitted by SRP.
	September - Draft Focused Remedial Investigation and Feasibility Study Work Plan, prepared by Hydro Geo Chem, Inc.
	December - Quality Management Plan prepared by Geomatrix Consultants, Inc. (Geomatrix).
	December - Revised Research Report submitted by SRP.
2005	January - Revised Remedial Action Objectives Technical Memorandum prepared by Geomatrix.
	January - Focused Remedial Investigation and Feasibility Study Work Plan prepared by Geomatrix.
	February - Final Quality Management Plan submitted to EPA.
	April - EPA approves Final Quality Management Plan.

TABLE 1
EVENT CHRONOLOGY
Salt River Project's 16th Street Facility
Phoenix, Arizona

Date	Activity
2005	April - Final Technical Memorandum Summarizing Remedial Action Objectives for the 16 th Street Remedial Investigation/Feasibility Study prepared by Geomatrix.
	July - EPA approves Technical Memorandum Summarizing Remedial Action Objectives and Response to EPA comments.
	September - Revised Focused Remedial Investigation and Feasibility Study Work Plan prepared by Geomatrix.
	October - EPA approves Focused Remedial Investigation and Feasibility Study Work Plan.
2006	February - Technical Memorandum Regarding the Initial Phase of the Focused Remedial Investigation prepared by Geomatrix.
	February - Draft Air Sampling Work Plan - Buildings 1, 4, and 34 prepared by Geomatrix.
	April - Air Sampling Letter Report prepared by Geomatrix after first round of sampling prepared by Geomatrix.
	April - Revised Technical Memorandum Regarding the Initial Phase of the Focused Remedial Investigation.
	July - Results of June 2006 Active Soil Gas Sampling and Analytical Reports (Phase II), transmitted via e-mail by Geomatrix.
	August - Final Air Sampling Work Plan - Buildings 1, 4, and 34 prepared by Geomatrix.
	August - Sump Removal Work Plan prepared by Geomatrix.
	September - Site Health and Safety Plan for Sump Removal prepared by Geomatrix.
	September - EPA approves Final Air Sampling Work Plan - Buildings 1, 4, and 34.
	October - EPA approves Final Sump Removal Work Plan.
	October - Revised Site Health and Safety Plan for Sump Removal prepared by Geomatrix.
	December - Draft Indoor Air Quality Report prepared by Geomatrix.
2007	January - Sump Removal Report prepared by Geomatrix.
	February - Draft Soil Vapor Monitor Well Installation Report prepared by Geomatrix.
	March - Final Indoor Air Quality Report prepared by Geomatrix.
	April - Final Sump Removal Report prepared by Geomatrix.
	April - Final Soil Vapor Monitor Well Installation Report submitted to EPA.
	April - Summary of Purge Test Data submitted to EPA.
	May - EPA approves Final Indoor Air Quality Report.
	May - EPA approves Summary of Purge Test Data prepared by Geomatrix.
	May - EPA approves Final Soil Vapor Monitor Well Installation Report.
	June - EPA and ADEQ approve Final Sump Removal Report.
	September -Technical Memorandum Regarding the Results of the Soil Vapor Monitor Well Sampling and Modeling Activities submitted to EPA.
	December - EPA approves Technical Memorandum Regarding the Results of the Soil Vapor Monitor Well Sampling and Modeling Activities.
2008	January - ADEQ approves Technical Memorandum Regarding the Results of the Soil Vapor Monitor Well Sampling and Modeling Activities.

TABLE 2
MONITOR WELL CONSTRUCTION DETAILS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Monitor Well Identification	ADWR No.	Completion Date	Drill Depth (feet bgs)	Casing				Current Monitoring Frequency	
				Top of Casing (feet above msl)	Diameter (inches)	Depth Interval (feet bgs)	Screened Interval (feet bgs)	Water Levels	Water Quality
16ST-01	55-584402	Jan-01	110	1092.99	4	0-110	60-110	Semi-Annual	Semi-Annual
16ST-02	55-584403	Jan-01	110	1093.38	4	0-110	60-110	Semi-Annual	Semi-Annual
16ST-03	55-584401	Jan-01	110	1092.42	4	0-110	60-110	Semi-Annual	Semi-Annual
16ST-04	55-584404	Jan-01	110	1092.13	4	0-110	60-110	Semi-Annual	Semi-Annual

Notes:

ADWR No. = Arizona Department of Water Resources Number

bgs = below ground surface

msl = mean sea level

TABLE 3
WATER LEVELS IN MONITOR WELLS, 2001-2008
Salt River Project's 16th Street Facility
Phoenix, Arizona

Monitor Well Number	Date of Measurement	Depth to Water (feet-bmp)	Groundwater Elevation (feet above msl)
16ST-01	6/05/01	75.69	1017.3
	9/05/01	78.39	1014.6
	12/03/01	81.19	1011.8
	3/19/02	82.29	1010.7
	6/10/02	84.69	1008.3
	9/24/02	87.79	1005.2
	12/09/02	89.09	1003.9
	3/10/03	88.09	1004.9
	6/16/03	89.09	1003.9
	9/03/03	90.99	1002.0
	12/08/03	92.39	1000.6
	3/08/04	91.59	1001.4
	6/09/04	92.59	1000.4
	3/08/05	91.00	1002.0
	3/21/06	87.71	1005.3
	9/06/06	89.99	1003.0
	3/19/07	87.98	1005.0
	9/06/07	90.27	1002.7
	3/17/08	89.06	1003.9
16ST-02	6/05/01	75.88	1017.5
	9/05/01	78.58	1014.8
	12/03/01	81.68	1011.7
	3/19/02	82.78	1010.6
	6/10/02	85.18	1008.2
	9/24/02	88.18	1005.2
	12/09/02	89.58	1003.8
	3/10/03	88.48	1004.9
	6/16/03	89.58	1003.8
	9/03/03	91.48	1001.9
	12/08/03	92.98	1000.4
	3/08/04	92.08	1001.3
	6/09/04	92.98	1000.4
	3/08/05	91.81	1001.6
	3/21/06	88.19	1005.2
	9/06/06	90.44	1002.9
	3/19/07	88.47	1004.9
	9/06/07	90.64	1002.7
	3/17/08	89.71	1003.7

TABLE 3
WATER LEVELS IN MONITOR WELLS, 2001-2008
Salt River Project's 16th Street Facility
Phoenix, Arizona

Monitor Well Number	Date of Measurement	Depth to Water (feet-bmp)	Groundwater Elevation (feet above msl)
16ST-03	6/05/01	75.22	1017.2
	9/05/01	77.82	1014.6
	12/03/01	81.12	1011.3
	3/19/02	82.22	1010.2
	6/10/02	84.62	1007.8
	9/24/02	87.62	1004.8
	12/09/02	88.92	1003.5
	3/10/03	87.82	1004.6
	6/16/03	88.92	1003.5
	9/03/03	90.72	1001.7
	12/08/03	92.22	1000.2
	3/08/04	91.32	1001.1
	6/09/04	92.22	1000.2
	3/08/05	91.43	1001.0
	3/21/06	87.62	1004.8
	9/06/06	89.99	1002.4
	3/19/07	87.98	1004.4
	9/06/07	90.25	1002.2
	3/17/08	89.35	1003.1
16ST-04	6/05/01	75.43	1016.7
	9/05/01	78.03	1014.1
	12/03/01	80.93	1011.2
	3/19/02	82.03	1010.1
	6/10/02	84.43	1007.7
	9/24/02	87.53	1004.6
	12/09/02	88.83	1003.3
	3/10/03	87.73	1004.4
	6/16/03	88.73	1003.4
	9/03/03	90.63	1001.5
	12/08/03	92.13	1000.0
	3/08/04	91.23	1000.9
	6/09/04	92.13	1000.0
	3/08/05	91.05	1001.1
	3/21/06	87.41	1004.7
	9/06/06	89.85	1002.3
	3/19/07	87.80	1004.3
	9/06/07	90.09	1002.0
	3/17/08	89.04	1003.1

Notes:

bmp = below measuring point - top of casing; refer to Table 2.

msl = mean sea level

TABLE 4
SUMMARY OF PREVIOUS SITE INVESTIGATIONS AND SAMPLING EVENTS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Date	Investigation	Sample Matrix	Analyses*
Jul-87	UST Investigation SSG-6 and -7 (Weed Oil - later Transformer Oil)	Soil (Grab Samples - unspecified locations)	PCBs (8080)
Dec-87	Transformer Oil Analysis SSG-1, -2, -3, and -4 (Transformer Oil)	Mineral Oil	PCBs
Mar-88	UST Investigation SSG-1, -2, -3, and -4 (Transformer Oil)	Soil (Three Grab Samples)	PCBs (8080), TPHC
Sep-88	UST Investigation SSG-5, -6, -7, and -8 (Weed Oil - later Transformer Oil)	Soil (Five Grab Samples)	PCBs (8080), TPHC
Nov-88	UST Investigation SSG-5, -6, -7, and -8 (Weed Oil - later Transformer Oil)	Soil (15 Borings; 10 Samples, Sample Depth 5-20 feet bgs)	TPHC, Pesticides/PCBs (8080), BTEX (8020)
Mar-89	UST Investigation SSG-11 (Waste Oil)	Soil (Three Grab Samples)	TPHC
May-89	Grease Trap Interceptor SSG-19I	Liquid	VOCs (8010/8020)
Jun-89	Environmental Site Assessment Shallow Soils	Soil (35 Borings; 27 Samples, Sample Depth 5-7 feet bgs)	PCBs/Pesticides (8080), Hydrocarbons C6-C30 (8015M), VOCs (8010/8020), Phenols (8040)
Sep-89	Grease Trap Interceptor SSG-24I	Liquid	VOCs (8010/8020)
Jun-90	Drywell Investigation DW-2	Soil (One Soil Probe Boring; Three Samples, Sample Depths 3-6, 8-12, 12-13 feet bgs)	PCBs, TPHC, VOCs (8010/8020), Fuel Fingerprint

TABLE 4
SUMMARY OF PREVIOUS SITE INVESTIGATIONS AND SAMPLING EVENTS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Date	Investigation	Sample Matrix	Analyses*
Jul-90	Fireline Trench Investigation (Abandoned Weed Oil Pipeline from SSG-5, -6, -7, and -8 Encountered)	Soil (One Grab Sample)	PCBs, TPHC, VOCs (8010/8020)
Dec-93	UST Investigation SSG-9 and -10 (Gasoline, Diesel)	Soil (Six Grab Samples)	TPHC, Semi-VOCs
2001	Groundwater Investigation 16ST-01, -02, -03, and -04	Groundwater (On-going quarterly monitoring)	VOCs (601/602)
2002	Shallow Soil Gas Survey	Soil Gas (Sample Depth 1-5 feet bgs)	VOCs (GC/MS)

Notes:

Investigations involving COCs analyses is highlighted.

*EPA Method in parenthesis. Blank where method unknown.

COCs = Site Contaminants of Concern

EPA = United States Environmental Protection Agency

UST = Underground Storage Tank

PCBs = Polychlorinated Biphenyls

TPHC = Total Petroleum Hydrocarbons

bgs = below ground surface

BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes

VOCs = Volatile Organic Compounds

GC/MS = Gas Chromatography/Mass Spectrometry

TABLE 5
SUMMARY OF SUMPS AND GREASE TRAP INTERCEPTORS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sump/Interceptor Identification	Approximate Date Installed	Approximate Date Removed	Waste Streams - Past or Present	City of Phoenix Drain Connection	COCs Known or Suspected	Status	Previous VOCs Analysis Conducted	Drawing Number	Active Soil Gas Location	Associated Potential Source Area[5]
Wash Stall Sump A	1929	1958	Vehicle Wash Stall - Transportation Garage	Sewer	No	Removed	No	na	Yes	na
SSG-12S	1966	na	Evaporative Cooling Water	Storm Drain	No	Active	No	A-67-22 (1965) A-67-24 (1966)	Yes	na
SSG-13S	1966	na	Vehicle Steam Cleaning - Unloading Ramp Heavy Equipment Garage	Sewer	No	Inactive	No	A-67-27 (1967)	Yes	na
SSG-14S	1972	na	Lube Pit - Transportation Garage	Storm Drain 1972 - 1989 Sewer 1989 - present	Yes	Active	No	A-687-P3	Yes	PSA 2A
SSG-15I	1966	2006	Floor Drainage - Heavy Equipment Garage Sump SSG-13S	Sewer	Yes	Removed	No	A-67-22 (1965) A-67-24 (1966)	Yes	PSA 2C
SSG-16I	1965	na	Oily Waste/Steam Cleaning - Electric Shop (Building 3)	Catch Basin[1] 1951 - 1979 Storm Drain 1979 - present[2]	Yes	Active	No	A-51-13 (1965)	Yes	PSA 1
SSG-17I	1960	na	Vehicle Wash Stall (Building 36)	Storm Drain 1960 - 1989 Sewer 1989 - present	No	Active	No	A-32-70 (1989) B-143-2 (1958)	Yes	na
SSG-18I	1953	1993	Gas Island - Transportation Garage	Storm Drain	No	Removed	No	A-34-20 (1953)	Yes	na
SSG-19I	1958	1989	Oily Waste - Transportation Garage	Storm Drain 1958 - 1989	Yes	Removed	Yes[3]	A-67-630	Yes	PSA 2A
SSG-20I	1954	na	Vehicle Wash Stall - Repair Garage	Storm Drain	No	Inactive	No	na	Yes	na
SSG-21T	1936	na	SSG-14S; SSG-19I; Floor Drainage - Repair Garage; SSG-20I	Storm Drain	Yes	Active	No	na	Yes	na
SSG-22N	1972	na	Battery Waste (Building 39)	Storm Drain 1972 - 1989 Sewer 1989 - present	No	Inactive	No	na	Yes	PSA 2A and 2B
SSG-23I	1989	na	SSG-22N, SSG-17I	Sewer	No	Active	No	A-32-70	Yes	na
SSG-24I	1989	na	SSG-14S Floor Drainage - Transportation Garage (Building 37)	Sewer	Yes	Active	Yes[4]	na	Yes	PSA 2A

Notes:

[1]Building 37 - Parts Washer.

[2]Storm Drain piping from SSG-16I was connected to a catch basin, which was later defined as a drywell, referred to here as DW-4. Salt River Project believes that the Catch Basin was abandoned in 1979, when the City of Phoenix made modifications to the storm drain in this area.

[3]May 1989 Results for VOC analysis - 1,1,1-TCA = 400 µg/L; PCE = 45 µg/L; 1,1-DCA = 50 µg/L

[4]May 1989 Results for VOC analysis - 1,1,1-TCA = 970 µg/L; 1,1 DCA = 430 µg/L; 1,1-DCE/VDC = 310 µg/L

[5]Potential Source Area (PSA) as defined in the Research Report (SRP, 2004).

COCs = Site Contaminants of Concern
VOCs = Volatile Organic Compounds
na = not available.
1,1,1-TCA = 1,1,1-Trichloroethane
PCE = Tetrachloroethene
1,1-DCA = 1,1-Dichloroethane
1,1-DCE = 1,1-Dichloroethene
VDC = Vinylidene Chloride
µg/L = microgram per liter

TABLE 6
CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS IN SUMP LIQUIDS - 1989

Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per liter (µg/L)

Sample Date	May-89	May-89	Sep-89
Sump ID	**SSG-19I**	**SSG-19I**	**SSG-24I**
Sample ID	**16T-89-005**	**16T-89-006**	**16MHOIW**
Constituents			
Benzene	**250**	<25	<25
Bromochloromethane	<10.0	<10.0	NA
Bromodichloromethane	NA	NA	<25
Bromoform	<10.0	<10.0	<50
Bromomethane	<10.0	<10.0	NA
Carbon Tetrachloride	<10.0	<10.0	<25
Chlorobenzene	<25.0	<25.0	<25
Chloroethane/Ethyl Chloride*	<10.0	<10.0	NA
Chloroform	<10.0	<10.0	<25
Chloromethane	<10.0	<10.0	NA
Dibromochloromethane	<10.0	<10.0	<25
1,2-Dichlorobenzene	<25.0	<25.0	<25
1,3-Dichlorobenzene	<25.0	<25.0	<25
1,4-Dichlorobenzene	<25.0	<25.0	<50
2-Chloroethlyl Vinyl Ether	<25.0	<25.0	<50
Dichlorodifluoromethane	<10.0	<10.0	NA
1,1-Dichloroethane*	**50**	<10	**430**
1,2-Dichloroethane*	<10.0	<10.0	<25
1,1-Dichloroethene/Vinylidene Chloride*	<10.0	<10.0	**310**
1,2-Dichloroethene (Total)*	<10.0	<10.0	NA
trans-1,2-Dichloroethene*	NA	NA	<25
1,2-Dichloropropane	<10.0	<10.0	<25
cis-1,3-Dichloropropene	<10.0	<10.0	<50

TABLE 6
CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS IN SUMP LIQUIDS - 1989

Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per liter (µg/L)

Sample Date	May-89	May-89	Sep-89
Sump ID	SSG-19I	SSG-19I	SSG-24I
Sample ID	16T-89-005	16T-89-006	16MHOIW
Constituents			
trans-1,3-Dichloropropene	<10.0	<10.0	<25
Ethylbenzene	**200**	**98**	<25
Methylene Chloride	<100.0	<100.0	<25
1,1,2,2-Tetrachloroethane	<10.0	<10.0	<25
Tetrachloroethene*	**45**	<10	<25
Toluene	**1,730**	**560**	<50
1,1,1-Trichloroethane*	**400**	<10	**970**
1,1,2-Trichloroethane*	<10.0	<10.0	<25
Trichloroethene*	<10.0	<10.0	<25
Trichlorofluoromethane	<25.0	<25.0	**50**
Trichlorotrifluoroethane	<10.0	<10.0	NA
Vinyl Chloride/Chloroethene*	<10.0	<10.0	NA
meta Xylene	**820**	**440**	NA
ortho & para Xylenes	**720**	**390**	NA
meta/para Xylenes	NA	NA	<25
ortho Xylene	NA	NA	<25

Notes:
*Site Contaminants of Concern (COCs).
Bold values indicate detects.
ID = identification
NA = not analyzed
< = Analyte not detected at concentration greater than the reporting limit shown.

TABLE 7
ANALYTICAL RESULTS OF FIRE LINE TRENCH INVESTIGATION - JULY 1990

Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in microgram per kilogram (μg/kg)

Sample ID	16th St Pipe	16th St Trench-Subgrade
Sample Type	Sludge	Sub-grade Soil
Constituents		
Benzene	<2,500	<250
Bromodichloromethane	<2,500	<250
Bromoform	<2,500	<250
Bromomethane	NA	NA
Carbon Tetrachloride	<2,500	<250
Chlorobenzene	<2,500	<250
Chloroethane/Ethyl Chloride*	NA	NA
Chloroform	<2,500	<250
Chloromethane	NA	NA
2-Chloroethy Vinyl Ether	<2,500	<250
Dibromochloromethane	<2,500	<250
1,2-Dichlorobenzene	<2,500	**8,700**
1,3-Dichlorobenzene	<2,500	**9,300**
1,4-Dichlorobenzene	<2,500	**2,600**
Dichlorodifluoromethane	NA	NA
1,1-Dichloroethane*	<2,500	<250
1,2-Dichloroethane*	<2,500	<250
1,1-Dichoroethene/Vinylidene Chloride*	<2,500	<250
trans-1,2-Dichoroethene*	<2,500	<250
1,2-Dichloropropane	<2,500	<250
cis-1,3-Dichloropropene	<2,500	<250
trans-1,3-Dichloropropene	<2,500	<250
Ethylbenzene	**22,000**	<250
Methylene Chloride	<2,500	<250
1,1,2,2-Tetrachloroethane	<2,500	<250
Tetrachloroethene*	<2,500	<250
Toluene	<2,500	<250
1,1,1-Trichloroethane*	<2,500	<250
1,1,2-Trichloroethane*	<2,500	<250
Trichloroethene*	<2,500	<250
Trichlorofluoromethane	<2,500	<250
Vinyl Chloride/Chloroethene*	NA	NA
meta & para Xylenes	**11,000**	<250
ortho Xylene	**40,000**	<250

Notes:

*Site Contaminants of Concern (COCs).

Bold values indicate detects.

ID = identification

NA = not analyzed

< = Analyte not detected at concentration greater than the reporting limit shown.

TABLE 8
CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS IN SOIL SAMPLES COLLECTED FROM DRYWELL DW-2D - JUNE 1990

Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per kilogram (μg/kg)

Sample ID	SI 16DW2-A	SI 16DW2-B	SI 16DW2-C
Depth Interval	**3-6 ft bgs**	**8-12 ft bgs**	**12-13 ft bgs**
Constituents			
Benzene	<500	<500	<500
Bromodichloromethane	<500	<500	<500
Bromoform	<500	<500	<500
Bromomethane	NA	NA	NA
Carbon Tetrachloride	<500	<500	<500
Chlorobenzene	<500	<500	<500
Chloroethane/Ethyl Chloride*	NA	NA	NA
Chloroform	<500	<500	<500
Chloromethane	NA	NA	NA
2-Chloroethyl Vinyl Ether	<500	<500	<500
Dibromochloromethane	<500	<500	<500
1,2-Dichlorobenzene	<500	<500	<500
1,3-Dichlorobenzene	<500	<500	<500
1,4-Dichlorobenzene	<500	<500	<500
Dichlorodifluoromethane	NA	NA	NA
1,1-Dichloroethane*	<500	<500	<500
1,2-Dichloroethane*	<500	<500	<500
1,1-Dichloroethene/Vinylidene Chloride*	<500	<500	<500
trans-1,2-Dichloroethene*	<500	<500	<500
1,2-Dichloropropane	<500	<500	<500
cis-1,3-Dichloropropene	<500	<500	<500
trans-1,3-Dichloropropene	<500	<500	<500
Ethylbenzene	<500	<500	<500
Methylene Chloride	<500	<500	<500
1,1,2,2-Tetrachloroethane	<500	<500	<500
Tetrachloroethene*	<500	<500	<500
Toluene	<500	<500	<500
1,1,1-Trichloroethane*	<500	<500	<500
1,1,2-Trichloroethane*	<500	<500	<500
Trichloroethene*	<500	<500	<500
Trichlorofluoromethane	<500	<500	<500
Vinyl Chloride/Chloroethene*	NA	NA	NA
meta & para Xylenes	<500	**7,000**	<500
ortho Xylene	**700**	<500	<500

Notes:

* Site Contaminants of Concern (COCs).

Bold values indicate detects.

ID = identification

NA = not analyzed

< = Analyte not detected at concentration greater than the reporting limit shown.

ft bgs = feet below ground surface

TABLE 9
SUMMARY OF DRYWELLS REPORTED AND CONFIRMED
Salt River Project's 16th Street Facility
Phoenix, Arizona

Drywell ID	Location	Reported	Purpose (as reported)	Drawing Number	Active Soil Gas Location	Associated Potential Source Area *	Comments
DW-1A	East of Office Building 1	Gravel Drain Well - 1951	Site Drainage	Site Drawing B-16-31	Yes	PSA 4	--
DW-1B	East of Office Building 1	Gravel Drain Well - 1951	Site Drainage	Site Drawing B-16-31	Yes	PSA 4	--
DW-1C	East of Office Building 1	Catch Basin - 1951	Site Drainage	Site Drawing B-16-31	Yes	PSA 4	--
DW-2A	South of Building 34	Gravel Drain Well - 1951	Site Drainage	Site Drawing B-16-31	Yes	South of PSA 2C	--
DW-2B	Southwest of Building 34	Gravel Drain Well - 1951	Site Drainage	Site Drawing B-16-31	Yes	South of PSA 2C	--
DW-2C	South of Building 34	Catch Basin - 1951	Site Drainage	Site Drawing B-16-31	Yes	South of PSA 2C	--
DW-2D	Southwest of Building 34	Catch Basin - 1951	Site Drainage	Site Drawing B-16-31	Yes	South of PSA 2C	Previously sampled in 1990; Abandoned in the mid-1990s
DW-3A	Northeast of Electric Shop (Building 3)	Gravel Drain Well - 1951	Site Drainage	Site Drawing B-16-31	Yes	PSA 1	Replaced with SSG-16I
DW-3B	Northeast of Electric Shop (Building 3)	Catch Basin - 1951	Site Drainage	Site Drawing B-16-31	Yes	PSA 1	Replaced with SSG-16I
DW-4	Southern Boundary of 16th Street Facility	Catch Basin - 1951	Site Drainage	Site Drawing B-16-31	Yes	PSA 1	Identified by City of Phoenix as a drywell.
DW-5A	Inside Salvage Shed (Building 5)	Drywell - 1954	Water Cooler	Site Drawing A-78-1-1	Yes	PSA 3	Capped
DW-5B	Outside Salvage Shed (Building 5)	Drywell - 1972 Work Order No. 901-970	Water Cooler	na	Yes	PSA 3	Abandoned mid-1990s
DW-6	East End Meter Shop (Building 7)	Drywell - 1954	Refrigerated Unit Condensation	Site Drawing A-84-6.1	Yes	Outside PSA 3	--
DW-7	Northwest corner of Facility near Railroad Spur	Drywell	Roof Drainage??	na	Yes	In vicinity of PSA 5	--

Notes:
* Potential Source Area (PSA) as defined in Research Report (SRP, 2004).
ID = identification
na = not available
?? = not established
-- = not applicable

TABLE 10
SUMMARY OF SOIL GAS SURVEY - TRACE® RESEARCH, 2002
Salt River Project's 16th Street Facility
Phoenix, Arizona

Constituents	Number of Samples in which Constituents were Detected	Highest Concentration (ppmv)	Highest Concentration ($\mu g/m^3$)	Samples with Highest Concentration
Benzene	0	ND	--	--
Toluene	0	ND	--	--
Ethylbenzene	0	ND	--	--
Xylenes	0	ND	--	--
TVHC (C_4-C_9)	0	ND	--	--
Methylene Chloride	0	ND	--	--
1,1-Dichloroethene/Vinylidene Chloride*	0	ND	--	--
trans-1,2-Dichloroethene*	0	ND	--	--
cis-1,2-Dichloroethene*	0	ND	--	--
1,1-Dichloroethane*	0	ND	--	--
Chloroform	10	**0.001**	**4.88**	Various
1,1,1-Trichloroethane*	9	**0.0006**	**3.27**	SG-13-1', SG-13-3'
Carbon Tetrachloride	20	**0.00008**	**0.50**	SG-6-3'
1,2-Dichloroethane*	0	ND	--	--
Trichloroethene*	7	**0.004**	**21.50**	SG-23-1'
Tetrachloroethene*	50	**0.09**	**610.49**	SG-23-4'

Notes:

*Site Contaminants of Concern (COCs).

COCs not analyzed: Chloroethane/Ethyl Chloride, 1,1,2-Trichloroethane, Vinyl Chloride/Chloroethene, and 1,4-Dioxane

Bold values indicate detects.

ND = non-detect

-- = not applicable

ppmv = parts per million by volume

TVHC = Total Volatile Hydrocarbons

$\mu g/m^3$ = micrograms per cubic meter

TABLE 11
SOIL VAPOR MONITOR WELLS SCREENED INTERVALS

Salt River Project's 16th Street Facility
Phoenix, Arizona

SVMW	Approximate Screened Interval (feet bgs)
SVMW-1-1	82.5 to 83.5
SVMW-1-2	59 to 60
SVMW-1-3	32.5 to 33.5
SVMW-1-4	8 to 9
SVMW-2-1	82 to 83
SVMW-2-2	59 to 60
SVMW-2-3	32.5 to 33.5
SVMW-2-4	8 to 9

Notes:

bgs = below ground surface
SVMW = soil vapor monitor well

TABLE 12
CONCENTRATIONS OF SITE CONTAMINANTS OF CONCERN IN SOIL SAMPLES COLLECTED FROM SUMP SSG-15I

Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per kilogram (μg/kg)

		Constituents											
Sample ID	**PID (ppm)**	**CA/EC**	**1,1-DCA**	**1,2-DCA**	**1,1-DCE/ VDC**	**cis-1,2-DCE**	**trans-1,2-DCE**	**PCE**	**1,1,1-TCA**	**1,1,2-TCA**	**TCE**	**VC/CE**	**1,4-Dioxane**
SSG15I-SWN-6.0	1.2	<500	<50	<50	<100	<50	<50	<50	<50	<50	<50	<500	NA
SSG15I-SWE-6.0	1.6	<500	<50	<50	<100	<50	<50	<50	<50	<50	<50	<500	NA
SSG15I-SWW-6.0	1.1	<480	<48	<48	<96	<48	<48	<48	<48	<48	<48	<480	NA
SSG15I-SWS-6.0	1.1	<500	<50	<50	<100	<50	<50	<50	<50	<50	<50	<500	NA
SSG15I-V1-12.0	2.0	<490	<49	<49	<98	<49	<49	<49	<49	<49	<49	<490	NA
SSG15I-V2-12.0	1.1	<480	<48	<48	<96	<48	<48	<48	<48	<48	<48	<480	NA
SSG15I-V3-12.0	1.2	<490	<49	<49	<98	<49	<49	<49	<49	<49	<49	<490	NA
ADEQ Non-Residential SRL		*6.5E+04*	*1.7E+06*	*6.0E+03*	*4.1E+05*	*1.5E+05*	*2.3E+05*	*1.3E+04*	*1.2E+06*	*1.6E+04*	*6.5E+04*	*7.5E+02*	*1.6E+06*
ADEQ Residential SRL: 10^{-6} carcinogen risk		*3.0E+03*	--	*2.8E+02*	--	--	--	*5.1E+02*	--	*7.4E+02*	*3.0E+03*	*8.5E+01*	*5.0E+04*
10^{-5} carcinogen risk		*3.0E+04*	--	*2.8E+03*	--	--	--	*5.1E+03*	--	*7.4E+03*	*3.0E+04*	--	*5.0E+05*
ADEQ Residential SRL non-carcinogen		--	*5.1E+05*	--	*1.2E+05*	*4.3E+04*	*6.9E+04*	--	*1.2E+06*	--	*1.7E+04*	--	--
ADEQ GPL		*N*	*N*	*2.1E+02*	*8.1E+02*	*4.9E+03*	*8.4E+03*	*1.3E+03*	*1.0E+03*	*N*	*6.1E+02*	*N*	*N*

Notes:

The samples were collected on November 6, 2006.

< = Analyte not detected at concentration greater than the reporting limit shown.

ADEQ = Arizona Department of Environmental Quality

ppm = parts per million

ID = identification

COCs = Site Contaminants of Concern

CA = Chloroethane

CE = Chloroethene

EC = Ethyl Chloride

1,1-DCA = 1,1-Dichloroethane

1,2-DCA = 1,2-Dichloroethane

1,1-DCE = 1,1-Dichloroethene

cis-1,2-DCE = cis-1,2-Dichloroethene

trans-1,2-DCE = trans-1,2-Dichloroethene

PCE = Tetrachloroethene

1,1,1-TCA = 1,1,1-Trichloroethane

1,1,2-TCA = 1,1,2-Trichloroethane

TCE = Trichloroethene

VC = Vinyl Chloride

VDC = Vinylidene Chloride

-- = not applicable

PID = Photoionization detector

GPL = Groundwater Protection Level

SRL = Soil Remediation Level

NA = not analyzed

N = No established ADEQ GPL

TABLE 13
CONCENTRATIONS OF SITE CONTAMINANTS OF CONCERN IN MONITOR WELLS, 2001 - 2007
Salt River Project's 16th Street Facility
Phoenix, Arizona

Monitor Well Sampled : 16ST-01
Concentrations in microgram per liter (µg/L)

	Date Sampled																						
Constituents	**2/21/01**	**6/05/01**	**9/05/01**	**12/03/01**	**3/19/02**	**6/10/02**	**9/24/02**	**12/09/02**	**3/10/03**	**6/16/03**	**9/03/03**	**12/08/03**	**3/08/04**	**6/09/04**	**3/08/05**	**6/07/05**	**9/01/05**	**12/07/05**	**3/21/06**	**6/07/06**	**9/06/06**	**12/05/06**	**3/19/07**	**9/04/07**
Chloroethane/ Ethyl Chloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene/ Vinylidene Chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl Chloride/ Chloroethene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

TABLE 13
CONCENTRATIONS OF SITE CONTAMINANTS OF CONCERN IN MONITOR WELLS, 2001 - 2007
Salt River Project's 16th Street Facility
Phoenix, Arizona

Monitor Well Sampled : 16ST-02
Concentrations in microgram per liter (µg/L)

	Date Sampled																						
Constituents	**2/21/01**	**6/05/01**	**9/05/01**	**12/03/01**	**3/19/02**	**6/10/02**	**9/24/02**	**12/09/02**	**3/10/03**	**6/16/03**	**9/03/03**	**12/08/03**	**3/08/04**	**6/09/04**	**3/08/05**	**6/07/05**	**9/01/05**	**12/07/05**	**3/21/06**	**6/07/06**	**9/06/06**	**12/05/06**	**3/19/07**	**9/04/07**
Chloroethane/ Ethyl Chloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene/ Vinylidene Chloride	<0.5	<0.5	**0.7**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	**0.5**	**0.5**	**0.5**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl Chloride/ Chloroethene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

TABLE 13
CONCENTRATIONS OF SITE CONTAMINANTS OF CONCERN IN MONITOR WELLS, 2001 - 2007
Salt River Project's 16th Street Facility
Phoenix, Arizona

Monitor Well Sampled : 16ST-03
Concentrations in microgram per liter (µg/L)

	Date Sampled																						
Constituents	**2/21/01***	**6/05/01**	**9/05/01**	**12/03/01**	**3/19/02**	**6/10/02**	**9/24/02**	**12/09/02**	**3/10/03**	**6/16/03**	**9/03/03**	**12/08/03**	**3/08/04**	**6/09/04**	**3/08/05**	**6/07/05**	**9/01/05**	**12/07/05**	**3/21/06**	**6/07/06**	**9/06/06**	**12/05/06**	**3/19/07**	**9/04/07**
Chloroethane/ Ethyl Chloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-Dichloroethane	**5.2/4.8**	<0.5	**6.7**	**5.9**	**3.7**	**2.6**	**2.0**	**1.2**	**1.0**	<0.5	**0.6**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	**1.0/1.1**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene/ Vinylidene Chloride	**5.1/5.7**	**6.9**	**7.4**	**6.6**	**4.4**	**2.9**	**2.6**	**1.6**	**1.5**	**0.7**	**0.7**	**0.5**	**0.5**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene	<0.5	**1.1**	**1.4**	**1.0**	**0.7**	**0.5**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	**0.7/0.9**	**1.0**	**1.3**	**0.8**	**0.7**	**0.7**	<0.5	**0.5**	**0.6**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	**3.3/3.2**	**4.4**	**5.2**	**4.4**	**3.1**	**2.3**	**1.7**	**1.1**	**1.2**	**0.6**	**0.7**	**0.5**	**0.5**	**0.5**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl Chloride/ Chloroethene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

TABLE 13
CONCENTRATIONS OF SITE CONTAMINANTS OF CONCERN IN MONITOR WELLS, 2001 - 2007
Salt River Project's 16th Street Facility
Phoenix, Arizona

Monitor Well Sampled : 16ST-04
Concentrations in microgram per liter (µg/L)

	Date Sampled																						
Constituents	**2/21/01**	**6/05/01**	**9/05/01**	**12/03/01**	**3/19/02**	**6/10/02**	**9/24/02**	**12/09/02**	**3/10/03**	**6/16/03**	**9/03/03**	**12/08/03**	**3/08/04**	**6/09/04**	**3/08/05**	**6/07/05**	**9/01/05**	**12/07/05**	**3/21/06**	**6/07/06**	**9/06/06**	**12/05/06**	**3/19/07**	**9/04/07**
Chloroethane/ Ethyl Chloride	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene/ Vinylidene Chloride	<0.5	**0.5**	**0.9**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
cis-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,4-Dioxane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	<0.5	<0.5	**0.5**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	<0.5	<0.5	**0.7**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl Chloride/ Chloroethene	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Notes:
*These samples were analyzed by two labs - the first result is from Salt River Project; the second result is from Transwest Geochem, Inc.
Bold values indicate detects.
< = Analyte not detected at concentration greater than the reporting limit shown.
NA = not analyzed

TABLE 14
PHYSICAL PROPERTIES OF SOIL SAMPLES FROM SOIL VAPOR MONITOR WELLS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Borehole	Depth (feet bgs)	ASTM Soil Classification	Water Content (percent)	Dry Unit Weight (pounds per cubic feet)	Specific Gravity (unitless)	Total Organic Carbon (milligram/kilogram)
SVMW-1	7.5	clayey sand (SC)	13.1	97.9	2.666	<4,900
SVMW-1	12.5	poorly graded gravel with sand (GP)	2.8	NA	2.664	<5,000
SVMW-1	50	silty gravel with sand (GM)	3	111	2.667	<5,000
SVMW-1	60	silty, clayey gravel with sand (GC-GM)	3.1	NA	2.681	<5,000
SVMW-2	5	lean clay with sand (CL)	17.8	94.1	2.633	**5,600**
SVMW-2	35	well graded gravel with silt and sand (GW-GM)	2.4	NA	2.649	<4,900
SVMW-2	75	clayey sand with gravel (SC)	3.9	NA	2.604	<5,000

Notes:
Soil samples collected during soil vapor monitor well (SVMW) installation between January 22 to 26, 2006.
Bold value indicates detect.
< = Analyte not detected at concentration greater than the reporting limit shown.
ASTM = American Society for Testing and Materials.
NA = not analyzed
bgs = below ground surface

TABLE 15
ANALYTICAL RESULTS OF PASSIVE SOIL GAS SAMPLING EVENT - NOVEMBER 2005
Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms (µg)

Sample ID	Date Sampled	PCE*	TCE*	cis-1,2-DCE*	trans-1,2-DCE*	VC/ CE*	1,1,1-TCA*	1,1-DCE/ VDC*	1,1-DCA*	1,1,2-TCA*	1,2-DCA*	Chloroethane/ Ethyl Chloride*
SG-1	11/23/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-2	11/22/05	**0.05**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-3	11/21/05	**0.03**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-4	11/21/05	**0.07**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-5	11/22/05	**0.03**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-6	11/22/05	**0.09**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-7	11/21/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-8	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-9	11/23/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-10	11/23/05	**0.06**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-11	11/23/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-12	11/21/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-13	11/22/05	**0.11**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-14	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-15	11/22/05	**0.17**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-16	11/21/05	**0.15**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-17	11/22/05	**0.44**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-18	11/22/05	**0.49**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-19	11/22/05	**0.03**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-20	11/22/05	**0.04**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77

TABLE 15
ANALYTICAL RESULTS OF PASSIVE SOIL GAS SAMPLING EVENT - NOVEMBER 2005
Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms (µg)

Sample ID	Date Sampled	PCE*	TCE*	cis-1,2-DCE*	trans-1,2-DCE*	VC/ CE*	1,1,1-TCA*	1,1-DCE/ VDC*	1,1-DCA*	1,1,2-TCA*	1,2-DCA*	Chloroethane/ Ethyl Chloride*
SG-21	11/22/05	**0.40**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-22	11/22/05	**0.05**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-23	11/22/05	**0.05**	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-24	11/21/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-25	11/21/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-26	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-27	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-28	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-29	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-30	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-31	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-32	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-33	11/23/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-34	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-35	11/21/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-36	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-37	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-38	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-39	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SG-40	11/23/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77

TABLE 15
ANALYTICAL RESULTS OF PASSIVE SOIL GAS SAMPLING EVENT - NOVEMBER 2005
Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms (µg)

Sample ID	Date Sampled	PCE*	TCE*	cis-1,2-DCE*	trans-1,2-DCE*	VC/ CE*	1,1,1-TCA*	1,1-DCE/ VDC*	1,1-DCA*	1,1,2-TCA*	1,2-DCA*	Chloroethane/ Ethyl Chloride*
SGB-1	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SGB-2	11/21/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
SGB-3	11/23/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
trip blank	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
trip blank	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
trip blank	11/23/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
trip blank	11/21/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77
method blank	11/22/05	<0.03	<0.02	<0.03	<0.03	<0.77	<0.02	<0.03	<0.02	<0.02	<0.02	<0.77

Notes:

Bold values indicate detects
***** Site Contaminants of Concern (COCs), 1,4-Dioxane was not analyzed.
< = Analyte not detected at concentration greater than the reporting limit shown.
ID = identification
PCE = Tetrachloroethene
TCE = Trichloroethene
cis-1,2-DCE = cis-1,2-Dichloroethene
trans-1,2-DCE = trans-1,2-Dichloroethene
VC = Vinyl Chloride
CE = Chloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
1,1-DCE = 1,1-Dichloroethene
VDC = Vinylidene Chloride
1,1-DCA = 1,1-Dichloroethane
1,1,2-TCA = 1,1,2-Trichloroethane
1,2-DCA = 1,2-Dichloroethane

TABLE 16A
ANALYTICAL RESULTS OF ACTIVE SOIL GAS SAMPLING EVENT - NOVEMBER 2005
Salt River Project's 16th Street Facility
Phoenix, Arizona
Concentrations in micrograms per cubic meter (µg/m ^{3})

Sample ID	Date Sampled	PCE*	TCE*	cis-1,2-DCE*	trans-1,2-DCE*	VC/ CE*	1,1,1-TCA*	1,1-DCE/ VDC*	1,1-DCA*	1,1,2-TCA*	1,2-DCA*	Chloroethane/ Ethyl Chloride*	1,4-Dioxane*	Benzene	1,2,4-TCB	1,2,4-TMB	1,2-DCB	1,3-DCB	1,4-DCB	CB	EB	$CHCl_3$
ASG-1C-05 (1)	11/15/2005	<69	<55	<40	<40	<26	<55	<40	<41	<55	<41	<27	<370	<32	<150	<50	<61	<61	<61	<47	<44	<50
ASG-1-13	11/15/2005	**420**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**22**	<38	<12	<15	<15	<15	<12	<11	<12
ASG-2-15	11/16/2005	**280**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**12**	**83 J**	<12	**16 J**	<15	<15	<12	<11	<12
ASG-3-12	11/16/2005	**410**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**31**	**170 J**	<12 U	<15	<15	<15	<12	<11	<12
ASG-4C-05 (1)	11/15/2005	**2,800 J**	<1,100 UJ	<800 UJ	<800 UJ	<520 UJ	<1,100 UJ	<810 UJ	<820 UJ	<1,100 UJ	<820 UJ	<540 UJ	<730 UJ	<650 UJ	**900,000 J**	**1,300 J**	**210,000 J**	**9,800 J**	**130,000 J**	**2,100 J**	<880 UJ	<990 UJ
ASG-4-13.5	11/15/2005	**1,400**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<27	<370	<32	**44,000 J**	<50	**4,300 J**	**130**	**1,900 J**	<47	<44	<50
ASG-5-12	11/16/2005	**9,700**	**61**	<40	<40	<26	<55	<40	<41	<55	<41	<27	<370	<32	<150	<50	<61	<61	<61	<47	<44	<50
DUP-02-111605	11/16/2005	**8,300**	**61**	<40	<40	<26	<55	<40	<41	<55	<41	<27	<370	<32	<150	<50	<61	<61	<61	<47	<44	<50
ASG-6-12	11/16/2005	**2,400**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<27	<370	<32	<150	<50	<61	<61	<61	<47	<44	<50
ASG-7-12	11/17/2005	**830**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**23**	**53**	<12	<15	<15	<15	<12	<11	<12
ASG-8-10.5	11/17/2005	**500**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**55**	<38	<27 U	<15	<15	<15	<12	**27**	<12
ASG-9-11	11/17/2005	**4,300**	**72**	<40	<40	<26	<55	<40	<41	<55	<41	<27	<370	**36**	<150	**100**	<61	<61	<61	<47	<44	<50
ASG-10C-05	11/15/2005	**28**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**20**	**550 J**	<12	**31 J**	<15	<15	<12	<11	<12
ASG-10-15	11/15/2005	**130**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**18**	**630 J**	<12	**51 J**	<15	**19 J**	<12	<11	**27**
ASG-11-13	11/16/2005	**160**	<14	<10	<10	<6.5	**17**	<10	<10	<14	<10	<6.7	<92	**9.4**	<38	<12	<15	<15	<15	<12	<11	<12
ASG-12-15	11/17/2005	**97**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	<8.1	<38	<12	<15	<15	<15	<12	<11	<12
DUP-03-111705	11/17/2005	**76**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	<8.1	<38	<12	<15	<15	<15	<12	<11	<12
ASG-13-12	11/16/2005	**32**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**72**	**46**	<12	<15	<15	<15	<12	<11	<12
ASG-14-10	11/16/2005	**110**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**15**	<38	<12	<15	<15	<15	<12	<11	<12
ASG-15C-05	11/15/2005	**44**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**28**	**830 J**	<12	**54 J**	<15	**20 J**	<12	<11	<12
ASG-15-13	11/15/2005	**83**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**12**	**2,300 J**	<12	**130 J**	<15	**61 J**	<12	<11	<12
DUP-01-111505	11/15/2005	**97**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	<8.1	**440 J**	<12	**35 J**	<15	**16 J**	<12	<11	<12
ASG-16-14	11/17/2005	**25**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	<8.5 U	<38	<12	<15	<15	<15	<12	<11	**48**
BASG-1C-05	11/16/2005	**170**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**32**	<68 U	<12	<15	<15	<15	<12	<11	<12
BASG-1-11	11/16/2005	**230**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92	**42**	<83 U	<12	**18 J**	<15	<15	<12	<11	**35**
EB-02-111705	11/17/2005	<3.4	<2.8	<2	<2	<1.3	<2.8	<2	<2.1	<2.8	<2.1	<1.3	<18	<8.1	<7.5	**3.9**	<3.1	<3.1	<3.1	<2.4	<2.2	<2.5
FB-02-111705	11/17/2005	<3.4	<2.8	<2	<2	<1.3	<2.8	<2	<2.1	<2.8	<2.1	<1.3	<18	**2.4**	<7.5	**9.5**	<3.1	<3.1	<3.1	<2.4	**2.2**	<2.5
EB-01-111505	11/15/2005	<3.4	<2.8	<2	<2	<1.3	<2.8	<2	<2.1	<2.8	<2.1	<1.3	<18	<8.1	<7.5	**11.0**	<3.1	<3.1	<3.1	<2.4	<2.2	<2.5
FB-01-111505	11/15/2005	<3.4	<2.8	<2	<2	<1.3	<2.8	<2	<2.1	<2.8	<2.1	<1.3	<18	<8.1	**29**	<9.5	<3.1	<3.1	<3.1	<2.4	<2.2	<2.5

TABLE 16A
ANALYTICAL RESULTS OF ACTIVE SOIL GAS SAMPLING EVENT - NOVEMBER 2005
Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per cubic meter (µg/m ^{3})

Sample ID	Date Sampled	Acetone	Propene	MEK	CDS	Hexane	DCDFM	m&p-Xylene	2-Propanol	Ethyl Acetate	Chloromethane	Cyclohexane	o-Xylene	4-Ethyltoluene	Styrene	Heptane	Toluene	TCFM
ASG-1C-05 (1)	11/15/2005	<240	**77**	<60	<32	<36	<50	<88	<50	<37	<21	<35	<44	<44	<43	<42	<38	<57
ASG-1-13	11/15/2005	<200 U	**150**	<45	**51 J**	**23**	<13	<22	<12	<12 U	<5.2	**9.8**	<11	<11	<11	<10	**35**	<14
ASG-2-15	11/16/2005	<270 U	**82**	<57 U	**9.2 J**	**17**	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	**39**	**29**	**42**	**22**
ASG-3-12	11/16/2005	**460**	**330**	**120**	**44 J**	**43**	**20 J**	<22	<12	**23**	<5.2	<8.7	<11	<11	<11	<10	**65**	<14
ASG-4C-05 (1)	11/15/2005	<4,800 UJ	**1,000 J**	<1,200 UJ	<630 UJ	<710 UJ	<1,700 UJ	<1,800 UJ	<1,000 UJ	<730 UJ	<420 UJ	<700 UJ	<880 UJ	<880 UJ	<860 UJ	<830 UJ	<770 UJ	<1,100 UJ
ASG-4-13.5	11/15/2005	**580**	**140**	**72**	<32	<36	<50	<88	<50	<37	<21	<35	<44	<44	<43	<42	**96**	<57
ASG-5-12	11/16/2005	**340**	**160 J**	**81**	**66**	<36	<50	<88	<50	<37	<21	<35	<44	<44	<43	<42	<38	<57
DUP-02-111605	11/16/2005	**480**	**94 J**	<60 U	**38**	<36	<50	<88	<50	<37	<21	<35	<44	<37	<43	<42	<38	<57
ASG-6-12	11/16/2005	**550**	**460 J**	**170**	**79**	<36	<50	<88	<50	<37	<21	<35	<44	<44	<43	<42	<38	<57
ASG-7-12	11/17/2005	**430 J**	**230 J**	**130**	**54 J**	**20**	<13	<22	<12	<9.2	<5.2	**10**	<11	<11	<11	<10	<24 U	<8.9
ASG-8-10.5	11/17/2005	<190 U	**540 J**	**69**	**57 J**	**71**	<13	<53 U	<12	<9.2	<5.2	**34**	**20**	**14**	**11**	**87**	**77**	<8.9
ASG-9-11	11/17/2005	**600 J**	**520 J**	**150**	**57 J**	**36**	<50	<88	<50	<37	<21	<35	<44	<44	<43	<42	<38	<57
ASG-10C-05	11/15/2005	<80 U	**96**	<26 U	**13 J**	**20**	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	<10	**61**	<14
ASG-10-15	11/15/2005	<110 U	**150**	<30 U	**18 J**	**12**	**31 J**	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	<10	<20 U	<14
ASG-11-13	11/16/2005	<99 U	**42 J**	**30**	**27**	**10**	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	**12**	<12 U	<8.9
ASG-12-15	11/17/2005	**310 J**	**68 J**	**72**	**32 J**	<9 U	**18**	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	<10	<9.6	<14
DUP-03-111705	11/17/2005	**230 J**	**40 J**	**54**	**17 J**	<8.9	<13	<22	**27**	<9.2	<5.2	<8.7	<11	<11	<11	<10	<9.6	<14
ASG-13-12	11/16/2005	**840 J**	**610 J**	**200**	**73**	**22**	**16**	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	**21**	**54**	<14
ASG-14-10	11/16/2005	<150 U	**100 J**	**54**	**25**	**15**	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	<10	<19 U	<14
ASG-15C-05	11/15/2005	<220 U	**210**	<54 U	**32 J**	**27**	**26 J**	<22	<12	<9.2	<5.2	**13**	<11	<11	<11	<10	<29 U	<14
ASG-15-13	11/15/2005	<220 U	**110 J**	<54 U	**51 J**	**11**	**27 J**	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	<10	**45**	<14
DUP-01-111505	11/15/2005	<160 U	**100 J**	<42 U	**35 J**	<8.9	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	<10	**42**	<14
ASG-16-14	11/17/2005	<150 U	**75 J**	**42**	**14 J**	<9 U	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	**16**	<10 U	<14
BASG-1C-05	11/16/2005	<190 U	**120**	<39 U	**18**	**22**	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	**35**	<28 U	<14
BASG-1-11	11/16/2005	**410**	**330**	**110**	**85**	**24**	<13	<22	<12	<9.2	<5.2	<8.7	<11	<11	<11	<10	**33**	<57
EB-02-111705	11/17/2005	<12	**0.93**	<3.0	<1.6	<1.8	<2.5	<4.4	**3.7**	<1.8	< 1.0	<1.7	<2.2	<2.2	<2.2	<2.1	<1.9	<2.8
FB-02-111705	11/17/2005	**21**	**2.6**	<3.0	<1.6	**2**	**3**	**13**	<25	<1.8	**1.1**	<1.7	**3**	<2.2	<2.2	<2.1	**11**	<2.8
EB-01-111505	11/15/2005	<12	<0.88	<3.0	<1.6	<1.8	<2.5	<4.4	**5.7**	<1.8	<1.0	<1.7	**2.7**	<2.2	<2.2	<2.1	**2**	<2.8
FB-01-111505	11/15/2005	**34**	**1.6**	**6.9**	<1.6	<1.8	**2.6**	<4.4	**4**	**3.6**	**1.1**	<1.7	<2.2	<2.2	<2.2	<2.1	**6.1**	<2.8

Notes:

< = Analyte not detected at concentration greater than the reporting limit shown.
J = Analyte detected, reported concentration is an estimate.
UJ = Analyte was not detected above the reported sample quantitation limit, which is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte on the sample.
U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
(1) = Tracer compound 1,1-difluoroethane was detected in samples, and the associated analytical results were rejected using the previous guidance (EPA, 1999), however, using recent guidance (EPA, 2007), the data are now flagged as estimated.

Bold values indicate detects.
*Site Contaminants of Concern (COCs)
FB = field blank
EB- = equipment blank
ID = identification
MEK = 2-Butanone = Methl Ethyl Ketone
CDS = Carbon disulfide
DCDFM = Dichlorodifluoromethane (F-12)
TCFM = Trichlorofluoromethane (F-11)

BASG = Background Active Soil Gas Boring
ASG = Active Soil Gas Boring
PCE = Tetrachloroethene
TCE = Trichloroethene
cis-1,2-DCE = cis-1,2-Dichloroethene
trans-1,2,-DCE = trans-1,2-Dichloroethene
VC/CE = Vinyl Chloride/ Chloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
1,1-DCE = 1,1-Dichloroethene

1,1-DCA = 1,1-Dichloroethane
1,1,2-TCA = 1,1,2-Trichloroethane
1,2-DCA = 1,2-Dichloroethane
1,2,4-TCB = 1,2,4-Trichlorobenzene
1,2,4-TMB = 1,2,4-Trimethylbenzene
1,2-DCB = 1,2-Dichlorobenzene
1,3-DCB = 1,3-Dichlorobenzene
1,4-DCB = 1,4-Dichlorobenzene
CB = Chlorobenzene

EB = Ethylbenzene
VDC = Vinylidene Chloride
$CHCl_3$ = Chloroform
m&p = meta & para
o- = ortho
DUP = duplicate

EPA, 1999, Contract Laboratory Program National Functional Guidelines for Organic Data Review (OSWER 9240.1-05A-P PB99-963506, EPA 540/R-99-008), October.
EPA, 2007, Final Project Report for the Development of an Active Soil Gas Sampling Method, EPA/600/R-07/076, July.

TABLE 16B
ANALYTICAL RESULTS OF ACTIVE SOIL GAS SAMPLING EVENT - JUNE 2006
Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per cubic meter (µg/m³)

Sample ID	Date Sampled	PCE*	TCE*	cis-1,2-DCE*	trans-1,2-DCE*	VC/ CE*	1,1,1-TCA*	1,1-DCE/ VDC*	1,1-DCA*	1,1,2-TCA*	1,2-DCA*	Chloroethane/ Ethyl Chloride*	1,4-Dioxane*	Benzene	1,2,4-TCB	1,2,4-TMB	1,2-DCB	1,3-DCB	1,4-DCB	CB	EB	$CHCl_3$
ASG-17-5.0	6/13/2006	**500 J**	<11	<8	<8	<5.2	<11	<8.1	<8.2	<11	<8.2	<5.4	<73 UJ	**16**	<60	<10	<12	<12	<12	<9.4	<8.8	<9.9
ASG-17-12.0	6/13/2006	**620 J**	<5.5	<4	<4	<2.6	<5.5	<4	<4.1	<5.5	<4.1	<2.7	<37 UJ	**30**	<30	<5	<6.1	<6.1	<6.1	<4.7	<4.4	**8.9**
ASG-18-5.0	6/13/2006	**59 J**	<28	<20	<20	<13	<28	<20	<21	<28	<21	<13	<180 UJ	**52**	<150	<25	<31	<31	<31	<24	<22	<25
ASG-18-14.0	6/13/2006	**830 J**	<140	<100	<100	<65	<140	<100	<100	<140	<100	<67	<920 UJ	<81	<750	<120	<150	<150	<150	<120	<110	<120
ASG-19-5.0	6/13/2006	**540 J**	<28	<20	<20	<13	<28	<20	<21	<28	<21	<13	<180 UJ	**36**	<150	<25	<31	<31	<31	<24	<22	<25
ASG-19-13.0	6/13/2006	**180 J**	<28	<20	<20	<13	<28	<20	<21	<28	<21	<13	<180 UJ	**19**	<150	<25	<31	<31	<31	<24	<22	<25
DUP-02	6/13/2006	**270 J**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	**24**	<75	<12	<15	<15	<15	<12	<11	<12
ASG-20-5.0	6/13/2006	**50 J**	<28	<20	<20	<13	<28	<20	<21	<28	<21	<13	<180 UJ	**32**	<150	<25	<31	<31	<31	<24	**180**	<25
ASG-20-10.5	6/13/2006	**420 J**	<28	<20	<20	<13	<28	<20	<21	<28	<21	<13	<180 UJ	<16	<150	<25	<31	<31	<31	<24	<22	**26**
ASG-21-5.0	6/14/2006	**210 J**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<2.7	<370 UJ	**120**	<300	**95**	<61	<61	<61	<47	**330**	<50
ASG-21-15.0	6/14/2006	**190 J**	**270 J**	**80 J**	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	**24**	<75	**17**	<15	<15	<15	<12	<11	**40**
DUP-03	6/14/2006	**760 J**	**530 J**	**140 J**	<8	<5.2	<11	<8.1	<8.2	<11	<8.2	<5.4	<73 UJ	**32**	<60	**11**	<12	<12	<12	<9.4	**11**	**43**
ASG-22.5.0	6/13/2006	**2,900 J**	<28	<20	<20	<13	<28	<20	<21	<28	<21	<13	<180 UJ	**36**	<150	<25	<31	<31	<31	<24	<22	<25
ASG-22-14.0	6/13/2006	**1,200 J**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<2.7	<370 UJ	<32	<300	<50	<61	<61	<61	<47	<44	**130**
ASG-23-5.0	6/12/2006	**520**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	**49**	<75	<12	<15	<15	<15	<12	<11	<12
ASG-23-15.0	6/12/2006	**390**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<2.7	<370 UJ	**68**	<300	<50	<61	<61	<61	<47	<44	<50
ASG-24-5.0	6/12/2006	**1,700**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<2.7	<370 UJ	<32	<300	**100 J**	<61	<61	<61	<47	<44	<50
DUP-01	6/12/2006	**1,900**	<28	<20	<20	<13	<28	<20	<21	<28	<21	<13	<180 UJ	**39**	<150	**170 J**	<31	<31	<31	<24	<22	<25
ASG-24-15.0	6/12/2006	**970**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<2.7	<370 UJ	<32	<300	<50	<61	<61	<61	<47	**14**	<50
ASG-25-5.0	6/12/2006	**650**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	**30**	<7.5	**70 J**	<15	<15	<15	<12	**14**	<12
ASG-25-15.0	6/12/2006	**760**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	<8.1	<7.5	**39 J**	<15	<15	<15	<12	**14**	<12
ASG-26-5.0	6/12/2006	**400**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<2.7	<370 UJ	**210**	<300	<50	<61	<61	<61	<47	<44	<50
ASG-26-15.0	6/12/2006	**320**	<55	<40	<40	<26	<55	<40	<41	<55	<41	<2.7	<370 UJ	<32	<300	<50	<61	<61	<61	<47	<44	<50
ASG-27-5.0	6/12/2006	**25**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	**17**	<7.5	**19 J**	<15	<15	<15	<12	**13**	<12
ASG-27-13.0	6/12/2006	**110**	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	**11**	<7.5	<12	<15	<15	<15	<12	<11	<12
AMBIENT-01	6/12/2006	<3.4	**2.8**	<2	<20	<1.3	<2.8	<2	<2.1	<2.8	<2.1	<1.3	<18 UJ	<1.6	<15	<2.5	<3.1	<3.1	<3.1	<2.4	<2.2	<2.5
AMBIENT-02	6/13/2006	<3.4	<2.8	<2	<20	<1.3	<2.8	<2	<2.1	<2.8	<2.1	<1.3	<18 UJ	<1.6	<15	<2.5	<3.1	<3.1	<3.1	<2.4	<2.2	<2.5
EB-01	6/12/2006	<3.4	<2.8	<2	<20	<1.3	<2.8	<2	<2.1	<2.8	<2.1	<1.3	<18 UJ	<1.6	<15	**5.5**	<3.1	<3.1	<3.1	<2.4	<2.2	<2.5
EB-02	6/13/2006	<17	<14	<10	<10	<6.5	<14	<10	<10	<14	<10	<6.7	<92 UJ	<8.1	<75	<12	<15	<15	<15	<12	<11	<12

TABLE 16B
ANALYTICAL RESULTS OF ACTIVE SOIL GAS SAMPLING EVENT - JUNE 2006
Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per cubic meter (µg/m^3)

Sample ID	Date Sampled	Acetone	Propene	MEK	CDS	Hexane	DCDFM	m&p-Xylene	2-Propanol	Ethyl Acetate	Chloromethane	Cyclohexane	o-Xylene	4-Ethyltoluene	Styrene	Heptane	Toluene	TCFM	2,2,4-TMP	Methylene Chloride	Vinyl Acetate
ASG-17-5.0	6/13/2006	<270 U	**52**	**36 J**	**7.6 J**	<15 U	< 10	< 18	< 20	<44 U	< 4.2	< 7	< 8.8	< 8.8	< 8.6	<35 U	<16 U	< 11	< 9.5	< 7.1	< 7.1
ASG-17-12.0	6/13/2006	<220 U	**280**	**75 J**	**110 J**	<25 U	**6.5**	< 8.8	< 100	**27 J**	< 21	<5.2 U	< 4.4	< 4.4	< 4.3	**33 J**	<17 U	**6.8**	< 4	< 3.5	< 3.6
ASG-18-5.0	6/13/2006	<290 U	< 8.8	**39 J**	< 16	< 18	< 25	< 44	< 50	**73 J**	< 10	< 17	< 22	< 22	< 22	<24 U	< 19	< 28	< 24	< 18	< 18
ASG-18-14.0	6/13/2006	**2,000**	< 44	< 150	< 79	< 8.9	< 13	< 220	< 250	< 92	< 52	< 87	< 110	< 110	< 10	< 100	< 96	< 180	< 120	< 88	< 89
ASG-19-5.0	6/13/2006	**1,100**	**190**	**220 J**	**20 J**	<46 U	< 25	< 44	< 50	< 18	< 10	<23 U	< 22	< 22	< 22	**87 J**	**35**	< 28	< 24	< 18	< 18
ASG-19-13.0	6/13/2006	<460 U	< 8.8	**54 J**	**79 J**	<26 U	< 25	< 44	< 50	**300 J**	< 10	<21 U	< 22	< 22	< 22	<33 U	<28 U	< 28	**850 J**	< 18	< 18
DUP-02	6/16/2006	<360 U	< 4.4	**90 J**	**110 J**	<36 U	< 13	< 22	< 25	<40 U	< 5.2	< 8.7	< 11	< 11	< 11	<50 U	<22 U	< 14	< 12	< 8.8	< 8.9
ASG-20-5.0	6/13/2006	**1,200**	**170**	**30 J**	< 16	**30 J**	< 25	**620**	< 50	< 18	< 10	< 17	**97**	< 22	< 22	<28 U	<42 U	< 28	< 24	< 18	< 18
ASG-20-10.5	6/13/2006	<480 U	< 8.8	**75 J**	**41J**	<20 U	< 25	< 44	< 50	< 18	< 10	< 17	< 22	< 22	< 22	<32	< 19	< 28	< 24	< 18	< 18
ASG-21-5.0	6/14/2006	**770 J**	< 18	**150**	**73**	**170 J**	< 50	**1100**	< 100	< 37	< 21	**77 J**	**300**	**49**	< 43	**190 J**	**280**	< 57	< 47	< 35	< 36
ASG-21-15.0	6/14/2006	**210 J**	**100**	**42**	**21**	<22	< 13	<22	< 25	**77 J**	< 5.2	< 8.7	**12**	< 11	< 11	**21 J**	**33**	< 14	< 12	< 8.8	< 8.9
DUP-03	6/14/2006	**310 J**	**74**	**45**	**21**	**31 J**	< 10	**20**	< 20	< 7.3	< 4.2	**18 J**	**11**	< 8.8	< 8.6	**32 J**	**35**	< 11	**28 J**	**7.8**	< 7.1
ASG-22.5.0	6/13/2006	<310 U	**280**	**63**	< 16	**190**	< 25	< 44	< 50	< 18	< 10	< 17	< 22	< 22	< 22	**120**	<42	< 28	< 24	< 18	< 18
ASG-22-14.0	6/13/2006	< 240	**120**	< 60	**76**	< 36	< 50	< 88	< 100	< 37	< 21	< 35	< 44	< 44	< 43	< 42	< 38	< 57	< 47	< 35	< 36
ASG-23-5.0	6/12/2006	**140 J**	**23 J**	**36 J**	**8.2**	< 8.9	< 13	< 22	< 25	< 9.2	< 5.2	< 8.7	< 11	< 11	< 11	< 10	< 9.6	< 14	< 12	< 8.8	< 8.9
ASG-23-15.0	6/12/2006	**510 J**	**150 J**	**120 J**	< 32	< 36	< 50	< 88	< 100	< 37	< 21	< 35	< 44	< 44	< 43	< 42	**65**	< 57	< 47	< 35	< 36
ASG-24-5.0	6/12/2006	< 240	**120 J**	< 60	< 32	< 36	< 50	< 88	< 100	< 37	< 21	< 35	< 44	< 44	< 43	< 42	<38	< 57	< 47	< 35	< 36
DUP-01	6/12/2006	**700 J**	**130 J**	**99 J**	< 16	**39**	< 25	**44**	< 50	< 18	< 10	**17**	**24**	**75 J**	< 22	< 21	**33**	**28**	< 24	< 18	< 18
ASG-24-15.0	6/12/2006	**270 J**	**100 J**	**66 J**	**44**	< 36	< 50	< 88	< 100	**62**	< 21	< 35	< 44	< 44	< 43	< 42	< 38	< 57	< 47	< 35	< 36
ASG-25-5.0	6/12/2006	**430 J**	**140 J**	**100 J**	**9.8**	**24**	< 13	**62**	< 25	**18**	< 5.2	< 8.7	**26**	**26 J**	< 11	**50**	**46**	< 14	< 12	< 8.8	< 8.9
ASG-25-15.0	6/12/2006	**240 J**	**14 J**	**45 J**	< 32	< 8.9	< 13	**62**	< 25	**36**	< 5.2	< 8.7	**26**	**15 J**	< 11	< 1	**27**	**18**	< 12	< 8.8	< 8.9
ASG-26-5.0	6/12/2006	**390 J**	**260 J**	**93 J**	< 32	**75**	< 50	< 88	< 100	< 37	< 21	< 35	< 44	< 44	< 43	**120**	**65**	< 57	< 47	**95**	< 36
ASG-26-15.0	6/12/2006	**510 J**	**400 J**	**120 J**	< 32	**50**	< 50	< 88	< 100	< 37	< 21	< 35	< 44	< 44	< 43	**75**	< 38	< 57	< 47	< 35	< 36
ASG-27-5.0	6/12/2006	**1100 J**	**82 J**	**160 J**	< 7.9	**29**	< 13	**44**	< 25	**70**	< 5.2	< 8.7	**15**	< 11	< 11	< 1	**38**	< 14	< 12	< 8.8	< 8.9
ASG-27-13.0	6/12/2006	**340 J**	**160 J**	**60 J**	**24**	**12**	< 13	< 22	< 25	< 9.2	< 5.2	< 8.7	< 11	< 11	< 11	< 10	< 9.6	**49**	< 12	< 8.8	< 8.9
AMBIENT-01	6/12/2006	**41**	< 0.88	< 3.0	< 1.6	< 1.8	**3.4**	< 4.4	< 5	**2.6**	< 1.0	< 1.7	< 2.2	< 2.2	< 2.2	< 2.1	<2.4 U	< 2.8	< 2.4	< 1.8	< 1.8
AMBIENT-02	6/13/2006	< 12	< 0.88	< 3.0	< 1.6	< 1.8	**3.4**	< 4.4	< 5	< 1.8	**1.1**	< 1.7	< 2.2	< 2.2	< 2.2	< 2.1	<2.5 U	< 2.8	< 2.4	< 1.8	< 1.8
EB-01	6/12/2006	**29**	< 0.88	< 3.0	< 1.6	< 1.8	< 2.5	**5.7**	**25.0**	< 1.8	< 1.0	< 1.7	**3.0**	< 2.2	< 2.2	**3.2**	**5.4**	< 2.8	< 2.4	< 1.8	< 1.8
EB-02	6/13/2006	**210**	< 4.4	< 1.5	< 7.9	**23**	< 13	< 22	< 25	**11.0**	< 5.2	**38**	< 11	< 11	< 11	**16**	**15.0**	< 14	**76**	**39**	**11**

Notes:
Bold values indicate detects.
*Site Contaminants of Concern (COCs)
< = Analyte not detected at concentration greater than the reporting limit shown.
J = Analyte detected, reported concentration is an estimate.
UJ = Analyte was not detected above the reported sample quantitation limit, which is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte on the sample.
U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
Ambient = field blank
DUP = duplicate
EB- = equipment blank
ID = identification
ASG = Active Soil Gas Boring
MEK = 2-Butanone = Methl Ethyl Ketone
CDS = Carbon disulfide
DCDFM = Dichlorodifluoromethane (F-12)
TCFM = Trichlorofluoromethane (F-11)
2,2,4-TMP = 2,2,4-Trimethylpentane
PCE = Tetrachloroethene
TCE = Trichloroethene
cis-1,2-DCE = cis-1,2-Dichloroethene
trans-1,2,-DCE = trans-1,2-Dichloroethene
VC/CE = Vinyl Chloride/ Chloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
1,1-DCE/VDC = 1,1-Dichloroethene/Vinylidene Chloride
1,1-DCA = 1,1-Dichloroethane
1,1,2-TCA = 1,1,2-Trichloroethane
1,2-DCA = 1,2-Dichloroethane
1,2,4-TCB = 1,2,4-Trichlorobenzene
1,2,4-TMB = 1,2,4-Trimethylbenzene
1,2-DCB = 1,2-Dichlorobenzene
1,3-DCB = 1,3-Dichlorobenzene
1,4-DCB = 1,4-Dichlorobenzene
CB = Chlorobenzene
EB = Ethylbenzene
$CHCl_3$ = Chloroform
m&p = meta & para
o- = ortho

TABLE 17
MONTH 1, 2, AND 3 SOIL VAPOR MONITOR WELL SAMPLING RESULTS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Well ID	Approximate Screened Interval (feet bgs)	Sample ID	Sample Date	Constituents	
				PCE (µg/m^3)	TCE (µg/m^3)
SVMW-1-1	82.5 to 83.5	SVMW1-1	4/18/2007	**1,900**	**14**
		SVMW1-1	5/22/2007	**1,400**	<9.1
		SVMW1-1	6/20/2007	**1,300**	**11**
SVMW-1-2	59 to 60	SVMW1-2	4/18/2007	**940**	**61**
		SVMW1-2	5/22/2007	**820**	**48**
		SVMW1-2	6/20/2007	**790**	**63**
SVMW-1-3	32.5 to 33.5	SVMW1-3	4/18/2007	**750 J**	**36**
		SVMW1-3	5/22/2007	**750**	**29**
		SVMW1-3	6/20/2007	**700**	**30**
		SVMW1-3 (Duplicate)	6/20/2007	**760**	**33**
SVMW-1-4	8 to 9	SVMW1-4	4/18/2007	**4,000 J**	<38
		SVMW1-4	5/22/2007	**7,500**	<50
		SVMW1-4	6/20/2007	**6,600**	**88**
SVMW-2-1	82 to 83	SVMW2-1	4/18/2007	**1,700**	<13
		SVMW2-1 (Duplicate)	4/18/2007	**1,900**	<13
		SVMW2-1	5/22/2007	**2,000**	<15
		SVMW2-1 (Duplicate)	5/22/2007	**1,900**	<9.4
		SVMW2-1	6/20/2007	**1,700**	<2.5
SVMW-2-2	59 to 60	SVMW2-2	4/18/2007	**930 J**	<8.8
		SVMW2-2	5/22/2007	**840**	<4.9
		SVMW2-2	6/20/2007	**760**	**4.4**
SVMW-2-3	32.5 to 33.5	SVMW2-3	4/18/2007	**670**	**9.7**
		SVMW2-3	5/22/2007	**1,100**	**12**
		SVMW2-3	6/20/2007	**1,100**	**14**
SVMW-2-4	8 to 9	SVMW2-4	4/18/2007	**1,100**	**15**
		SVMW2-4	5/22/2007	**2,200**	**36**
		SVMW2-4	6/20/2007	**2,800**	**56**
--	--	Equipment Blank	4/18/2007	<1.3	<1.3
		Equipment Blank	5/22/2007	<1	<1
		Equipment Blank	6/20/2007	<1.3	<1.3
--	--	Ambient Air Blank	4/18/2007	<2.4	<2.4
		Ambient Air Blank	5/22/2007	<1.5	<1.5
		Ambient Air Blank	6/20/2007	<2.4	<2.4

Notes:
The results of tracer gas for Months 1, 2, and 3 soil vapor sampling passed the leak detection evaluation.
Bold values indicate detects.
< = Analyte not detected at concentration greater than the reporting limit shown.
PCE = Tetrachloroethene
TCE = Trichloroethene
-- = not applicable
µg/m^3 = micrograms per cubic meter
bgs = below ground surface
SVMW = soil vapor monitor well
J = Analyte detected, reported concentration is an estimate.
ID = Identification

TABLE 18
JUNE 2008 DETECTED SOIL SAMPLING RESULTS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Concentrations in micrograms per kilogram (µg/kg)

Constituents	ADEQ Residential SRL (10^{-6} Carcinogen Risk)	ADEQ Residential SRL (10^{-5} Carcinogen Risk)	ADEQ Non-Residential SRL	ADEQ GPL	SAMPLE ID NUMBER			
					SB-1-5.0	SB-1-11.0	SB-2-5.0	SB-2-13.0
Tetrachloroethene	510	5,100	13,000	1,300	**1.8**	**66**	<2.0	<9.7
Trichloroethene	3,000	30,000	65,000	600	<1.7	<9.8	<2.0	<9.7

Notes:
Soil samples collected during additional soil sampling on June 5, 2008.
Bold values indicate detects.
< = Analyte not detected at concentration greater than the reporting limit shown.
ADEQ = Arizona Department of Environmental Quality
SRL = Soil Remediation Level
GPL = Groundwater Protection Level
ID = identification

TABLE 19
JUNE 2008 PHYSICAL PARAMETERS FOR SOIL SAMPLES

Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample ID	Depth (feet bgs)	ASTM Soil Classification	TOC (mg/kg)	Moisture Content (%)	Soil Specific Gravity (unitless)	Total Porosity (%)
SB-1-5.0	5	lean clay with sand (CL)	ND (<5,000)	14.2	2.714	38.1
SB-1-11.0	11	clayey sand with cobbles (SC)*	ND (<5,100)	NA	NA	NA
SB-2-5.0	5	lean clay with sand (CL)	**5,500**	12.4	2.687	31.2
SB-2-13.0	13	sandy clay with cobbles (CL)	ND (<5,000)	2.3	2.683	27.9

Notes:

Soil samples collected during additional soil sampling on June 5, 2008.
Bold value indicates detect.
< = Analyte not detected at concentration greater than the reporting limit shown.
*Soil had black sand layer of about 2-3". Lens of lean clay was also encountered.
ND = non-detect
ASTM = American Society for Testing and Materials
NA = not analyzed
TOC = Total Organic Carbon
mg/kg = milligram per kilogram
% = percent
bgs = below ground surface
ID = identification

TABLE 20
VLEACH MODELING PARAMETERS
Salt River Project's 16th Street Facility
Phoenix, Arizona

VLEACH Model Parameter	Symbol	Units	Value	Rationale/Source
Site Properties				
Area of Source 1 (Polygon 1)	A1	ft^2	25	Estimated drywell dimensions (5 ft x 5 ft)
Area of Source 2 (Polygon 2)	A2	ft^2	50	Estimated sump dimensions (5 ft x 10 ft)
Area of Source 3 (Polygon 3)	A3	ft^2	195	Estimated storm drain pipe dimensions (1 ft x 195 ft)
Depth to Groundwater	Dgw	ft	90	Shaw, 2007*
Rainfall Recharge Rate	Q	ft/yr	0.0875	15% infiltration of annual average rainfall (7 inches per year)
Model Parameters				
Time Step Length	--	years	0.1	Professional judgment
Simulation Time	--	years	30	Professional judgment
Groundwater Impact Output Interval	--	years	1	Professional judgment
Vertical Cell thickness	--	foot	1	Professional judgment
Upper Boundary Condition for vapor	BC	mg/L	-1.0	Assumes top of soil layer is impermeable to atmospheric diffusion
Lower Boundary Condition for vapor	BC	mg/L	0.0	Conservative assumption; overestimates diffusion into saturated zone

Chemical Parameters for Tetrachloroethene			**Source**	
			EPA, 2004c*	Ravi and Johnson, 1997*
Henry's Law Constant, dimensionless	H'	--	0.754	0.92
Organic Carbon Coefficient	Koc	mL/g	155	150
Water Solubility	S	mg/L	200	660.69
Air Diffusion Coefficient	Da	m^2/d	0.62	0.62

Notes:

ft^2 = square foot
mg/L = milligrams per liter
mL/g = milliliters per gram
m^2/d = square meters per day
ft/yr = feet per year
EPA = United States Environmental Protection Agency
% = percent
ft = feet
*Refer to Section 11.0 - References
(-) = negative
-- = not applicable

TABLE 21
VLEACH MODELING SOIL CHARACTERISTIC PROPERTIES
Salt River Project's 16th Street Facility
Phoenix, Arizona

Measured Results - Soil Properties

Boring	Approximate Depth (feet bgs)	Dry Density (lbs/ft^3)	Dry Density (g/cm^3)	Moisture Content (%)	Specific Gravity (g/cm^3)	Soil Bulk Density (g/cm^3)	Fraction of Organic Carbon[(1)]	Total Porosity[(1)]	Air-Filled Porosity[(1)]	Water-Filled Porosity [(1)]
SVMW-1	**7.5**	**97.9**	**1.568**	**13.1**	**2.666**	**1.774**	**<0.0049**	**0.412**	**0.206**	**0.205**
	12.5	NA	NA	2.8	2.664	NA	<0.005	na	na	na
	50	111.0	1.778	3.0	2.667	1.831	<0.005	0.333	0.280	0.053
	60	NA	NA	3.1	2.681	NA	<0.005	na	na	na
SVMW-2	**5**	**94.1**	**1.507**	**17.8**	**2.633**	**1.776**	**<0.005**	**0.428**	**0.159**	**0.268**
	35	NA	NA	2.4	2.649	NA	<0.0049	na	na	na
	75	NA	NA	3.9	2.604	NA	<0.005	na	na	na
Average at 5 - 10 ft	**--**	**96.0**	**1.538**	**15.45**	**2.65**	**1.775**	**--**	**0.420**	**0.183**	**0.237**

Observed/Measured Results - Soil Description

Boring	Approximate Depth (feet bgs)	ASTM Soil Classification	Gravel (%)	Sand (%)	Total Gravel and Sand (%)	Silt (%)	Clay (%)	Grand Total (%)	EPA, 2004c* Classification Based on Total Sands and Gravels
SVMW-1	7.5	clayey sand (SC)	0.9	57	57.9	30.3	11.8	100	sandy clay loam
	12.5	poorly graded gravel with sand (GP)	66.4	30	96.4	2	1.2	99.6	sand
	50	silty gravel with sand (GM)	37.8	35.6	73.4	9.8	6	89.2	sand
	60	silty, clayey gravel with sand (GC-GM)	38.9	33.2	72.1	9.3	6.4	87.8	sand
SVMW-2	5	lean clay with sand (CL)	0	19	19	54.1	26.9	100	clay
	35	well-graded gravel with silt and sand (GW-GM)	45.3	29.7	75	4.7	3	82.7	sand
	75	clayey sand with gravel (SC)	27.8	29.5	57.3	11.1	6.4	74.8	sandy clay loam

Basis for Modeling

Boring	Approximate Depth (feet bgs)	Applicable Depth Range for Model (feet bgs)	Basis For Assumptions	Dry Density (lbs/ft^3)	Dry Density (g/cm^3)	Moisture Content (%)	Specific Gravity (g/cm^3)	Average				Interval-Weighted Average				
								Soil Bulk Density (g/cm^3)	Total Porosity[(1)]	Air-Filled Porosity[(1)]	Water-Filled Porosity[(1)]	Length of Depth Interval (feet)	Soil Bulk Density (g/cm^3)	Total Porosity[(1)]	Air-Filled Porosity[(1)]	Water-Filled Porosity[(1)]
Average of samples between 5 and 10 foot depths	7.5	0 to 12	Measured	96	1.538	15.450	2.650	1.77	0.420	0.183	0.237	12	0.213	0.050	0.022	0.028
SVMW-2	35	13 to 42	Default - sand*	--	--	--	--	1.66	0.375	0.322	0.053	30	0.498	0.113	0.097	0.016
SVMW-1	50	43 to 63	Measured	111	1.778	3.000	2.667	1.83	0.333	0.280	0.053	21	0.385	0.070	0.059	0.011
SVMW-2	75	64 to 80	Default - sandy clay loam*	--	--	--	--	1.63	0.384	0.238	0.146	17	0.277	0.065	0.040	0.025
Boring Logs	>80	81 to 90	Default - sand*	--	--	--	--	1.66	0.375	0.322	0.053	10	0.332	0.075	0.064	0.011
Weighted Average across all depths**								1.71	0.38	0.27	0.11	90	1.70	0.373	0.28	0.091

Notes:

EPA = United States Environmental Protection Agency
* EPA, 2004c is the source of typical values for soil type. Refer Section 11.0 - References.
** Interval-weighted average values used as input to the VLEACH modeling (shaded).
(1) = dimensionless
Bold results used to calculate average.
g/cm^3 = grams per cubic centimeter
lbs/ft^3 = pounds per cubic foot
NA = not analyzed
na = not available
% = percent
ft = feet
SVMW = soil vapor monitor well
-- = not applicable
bgs = below ground surface
ASTM = American Society for Testing and Materials
< = less than

TABLE 22
PREDICTED TETRACHLOROETHENE CONCENTRATIONS IN SOIL BASED ON MEASURED SOIL VAPOR CONCENTRATIONS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample ID	Sample Depth (feet bgs)	Soil Vapor Concentration (mg/m^3) [Csg]				Henry's Law Constant [H] (atm-m^3) (mol)	Dimensionless Henry's Law Constant [H'] (L-w) (L-a)	Koc (mL-w) (g-oc)	Kd (foc * Koc) (L-w) (kg-s)	Default Assumptions EPA, 1996[2]	Site-specific Assumptions[1]					
		Month 1 4/18/2007	Month 2 5/22/2007	Month 3 6/20/2007	Maximum					Predicted Concentration in Soil (µg/kg) [Cs]	0 to 12 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	13 to 42 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	43 to 63 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	64 to 80 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	>80 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	Maximum Predicted Concentration in Soil (µg/kg) [Cs]
SVMW-1	8.0-9.0	4	7.5	6.6	7.5	1.84E-02	7.54E-01	155	9.30E-01	11.64	9.80	9.48	9.14	9.69	9.48	11.64
	32.5-33.5	0.75	0.75	0.7	0.75	1.84E-02	7.54E-01	155	9.30E-01	1.16	0.98	0.95	0.91	0.97	0.95	1.16
	59-60	0.94	0.82	0.79	0.94	1.84E-02	7.54E-01	155	9.30E-01	1.46	1.23	1.19	1.15	1.21	1.19	1.46
	82.5-83.5	1.9	1.4	1.3	1.9	1.84E-02	7.54E-01	155	9.30E-01	2.95	2.48	2.40	2.32	2.45	2.40	2.95
SVMW-2	8.0-9.0	1.1	2.2	2.8	2.8	1.84E-02	7.54E-01	155	9.30E-01	4.35	3.66	3.54	3.41	3.62	3.54	4.35
	32.5-33.5	0.67	1.1	1.1	1.1	1.84E-02	7.54E-01	155	9.30E-01	1.71	1.44	1.39	1.34	1.42	1.39	1.71
	59-60	0.93	0.84	0.76	0.93	1.84E-02	7.54E-01	155	9.30E-01	1.44	1.22	1.18	1.13	1.20	1.18	1.44
	82-83	1.7	2	1.7	2	1.84E-02	7.54E-01	155	9.30E-01	3.10	2.61	2.53	2.44	2.58	2.53	3.10

Input Parameters	Description	Units	Default Assumptions	Site-specific Assumptions[1]									
			EPA, 1996[2]	0 to 12 feet bgs	Source	13 to 42 feet bgs	Source	43 to 63 feet bgs	Source	64 to 80 feet bgs	Source	>80 feet bgs	Source
foc	Fraction of organic carbon	(g-oc)/(g-s)	0.006	0.005	Site-specific	0.005	Site-specific	0.005	Site-specific	0.005	Site-specific	0.005	Site-specific
PB	Dry bulk density	(kg-s)/(L-s)	1.5	1.77	Average value from samples at 5 and 7.5 feet	1.66	Sand[3]	1.83	Measured; SVMW-1, sample at 50 feet bgs	1.63	Sandy clay loam[3]	1.66	Sand [3]
Pt	Total porosity	(--)	0.43	0.42		0.38		0.33		0.38		0.38	
Pa	Air-filled Porosity	(L-a)/(L-s)	0.28	0.18		0.32		0.28		0.24		0.32	
Pw	Water-filled porosity	(L-w)/(L-s)	0.15	0.24		0.05		0.05		0.15		0.05	
CF	Conversion factor	(L/m^3)	1000	1000	--	1000	--	1000	--	1000	--	1000	--

Notes:

bgs = below ground surface
µg/kg = microgram per kilogram
mg/m^3 = milligrams per cubic meter
Koc = organic carbon soil-water partition coefficient
(L-w)/(L-a) = liter water per liter air
(mL-w)/(g-oc) = milliliter water per gram organic carbon
(L-w)/(kg-s) = liter water per kilogram soil
EPA = United States Environmental Protection Agency

[Cs] =Csg x (Pa + (Pw/H')+(Kd*PB)/H'))/(PB*CF)
Csg = soil vapor concentration
(atm-m^3)/(mol) = atmosphere-cubic meter per mole
(g-oc)/(g-s) = gram organic carbon per gram soil
(kg-s)/(L-s) = kilogram soil per liter soil
(L-a)/(L-s) = liter air per liter soil
(L-w)/(L-s) = liter water per liter soil
(L/m^3) = liter per cubic meter

Kd = soil-water partition coefficient
> = greater than
ID = identification
-- = not applicable
SVMW = soil vapor monitor well

[1] = Values derived in Table 5 -Soil Characteristic Properties (Geomatrix, 2007d) refer Section 11.0 - References; used in the estimation of the interval-specific soil concentrations calculated above
[2] = EPA Soil Screening Guidance: User's Guide, Office of Solid Waste and Emergency Response, July 1996, EPA540/R-96/018
[3] = Soil type for interval based on visual descriptions from boring logs; default properties for soil type: EPA, 2004c. Refer Section 11.0 - References
Shaded areas represent depths of soil gas measurements that are not associated with the depths of Site-specific soil properties.

TABLE 22A
PREDICTED TETRACHLOROETHENE CONCENTRATIONS IN SOIL BASED ON EPA REQUESTED MEASURED SOIL VAPOR CONCENTRATIONS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample ID	Sample Depth (feet bgs)	Soil Vapor Concentration (mg/m^3) [Csg]				Henry's Law Constant [H] (atm-m^3) (mol)	Dimensionless Henry's Law Constant [H'] (L-w) (L-a)	Koc (mL-w) (g-oc)	Kd (foc * Koc) (L-w) (kg-s)	Site-specific Assumptions[1]			
		Month 1 4/18/2007	Month 2 5/22/2007	Month 3 6/20/2007	Maximum					0 to 12 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	13 to 42 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	43 to 63 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	Maximum Predicted Concentration in Soil (µg/kg) [Cs]
SVMW-1	8.0-9.0	4	7.5	6.6	**9.7**	2.25E-02	9.20E-01	155	1.55E-01	4.91	4.30	4.05	4.91
	32.5-33.5	0.75	0.75	0.7	0.75	2.25E-02	9.20E-01	155	1.55E-01	0.38	0.33	0.31	0.38
	59-60	0.94	0.82	0.79	0.94	2.25E-02	9.20E-01	155	1.55E-01	0.48	0.42	0.39	0.48
SVMW-2	8.0-9.0	1.1	2.2	2.8	2.8	2.25E-02	9.20E-01	155	1.55E-01	1.42	1.24	1.17	1.42
	32.5-33.5	0.67	1.1	1.1	1.1	2.25E-02	9.20E-01	155	1.55E-01	0.56	0.49	0.46	0.56
	59-60	0.93	0.84	0.76	0.93	2.25E-02	9.20E-01	155	1.55E-01	0.47	0.41	0.39	0.47

Parameters	Description	Units	Site-Specific Assumptions [1]		
			0 to 12 feet bgs	13 to 42 feet bgs	43 to 63 feet bgs
foc	Fraction of organic carbon	(g-oc)/(g-s)	**0.001**	**0.001**	**0.001**
PB	Dry bulk density	(kg-s)/(L-s)	**1.65**	**1.65**	**1.65**
Pt	Total Porosity		0.42	0.38	0.33
Pa	Air-Filled Porosity	(L-a)/(L-s)	0.18	0.32	0.28
Pw	Water-Filled Porosity	(L-w)/(L-s)	0.24	0.05	0.05
CF	Conversion Factor	(L/m^3)	1000	1000	1000

Notes:

bgs = below ground surface
µg/kg = microgram per kilogram
mg/m^3 = milligrams per cubic meter
Koc = organic carbon soil-water partition coefficient
(L-w)/(L-a) = liter water per liter air
(mL-w)/(g-oc) = milliliter water per gram organic carbon
(L-w)/(kg-s) = liter water per kilogram soil
EPA = United States Environmental Protection Agency

[Cs] =Csg x (Pa + (Pw/H')+(Kd*PB)/H'))/(PB*CF)
Csg = soil vapor concentration
(atm-m^3)/(mol) = atmosphere-cubic meter per mole
(g-oc)/(g-s) = gram organic carbon per gram soil
(kg-s)/(L-s) = kilogram soil per liter soil
(L-a)/(L-s) = liter air per liter soil
(L-w)/(L-s) = liter water per liter soil
(L/m^3) = liter per cubic meter

Kd = soil-water partition coefficient
ID = identification
-- = not applicable
SVMW = soil vapor monitor well

[1] = Values derived in Table 5 -Soil Characteristic Properties (Geomatrix, 2007d) refer Section 11.0 - References; used in the estimation of the interval-specific soil concentrations calculated above.

Shaded areas represent depths of soil gas measurements that are not associated with the depths of Site-specific soil properties.
Shaded Bold values indicate EPA requested parameters.

TABLE 23
ESTIMATED TETRACHLOROETHENE CONCENTRATIONS IN SOIL USED IN VLEACH MODELING
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample ID	Sample Depth (feet bgs)	Model Depth (feet bgs)	Default Assumptions	Site-specific Assumptions[4]					Model Input		
			EPA, 1996[1] Predicted Concentration in Soil [Cs] (µg/kg)	0 to 12 feet bgs Predicted Concentration in Soil [Cs] (µg/kg)	13 to 42 feet bgs Predicted Concentration in Soil [Cs] (µg/kg)	43 to 63 feet bgs Predicted Concentration in Soil [Cs] (µg/kg)	64 to 80 feet bgs Predicted Concentration in Soil [Cs] (µg/kg)	>80 feet bgs Predicted Concentration in Soil [Cs] (µg/kg)	Maximum Predicted Concentration in Soil [Cs] (µg/kg)	Depth-Specific Concentration in Soil [Cs] (µg/kg)	Rationale
SVMW-1	--	0-8.0	--	--	--	--	--	--	11.64	9.80	Equal to following interval
	8.0-9.0	8.0-9.0	1.16E+01	9.80	9.48	9.14	9.69	9.48	11.64	9.80	measured
	--	9.0-33	--	--	--	--	--	--	6.40	5.38	average[2]
	32.5-33.5	33-34	1.16E+00	0.98	0.95	0.91	0.97	0.95	1.16	0.95	measured
	--	34-59	--	--	--	--	--	--	1.31	1.05	average[2]
	59-60	59-60	1.46E+00	1.23	1.19	1.15	1.21	1.19	1.46	1.15	measured
	--	60-83	--	--	--	--	--	--	2.20	1.77	average[2]
	82.5-83.5	83-84	2.95E+00	2.48	2.40	2.32	2.45	2.40	2.95	2.40	measured
	--	84-90	--	--	--	--	--	--	2.95	2.40	Equal to preceding depth intervals
SVMW-2	--	0-8.0	--	--	--	--	--	--	4.35	3.66	Equal to following interval
	8.0-9.0	8.0-9.0	4.35E+00	3.66	3.54	3.41	3.62	3.54	4.35	3.66	measured
	--	9.0-33	--	--	--	--	--	--	3.03	2.53	average[2]
	32.5-33.5	33-34	1.71E+00	1.44	1.39	1.34	1.42	1.39	1.71	1.39	measured
	--	34-59	--	--	--	--	--	--	1.58	1.26	average[2]
	59-60	59-60	1.44E+00	1.22	1.18	1.13	1.20	1.18	1.44	1.13	measured
	--	60-83	--	--	--	--	--	--	2.27	1.83	average[2]
	82-83	83-84	3.10E+00	2.61	2.53	2.44	2.58	2.53	3.10	2.53	measured
	--	84-90	--	--	--	--	--	--	3.10	2.53	Equal to preceding depth intervals
MAXIMUM[3]	--	0-8.0	--	--	--	--	--	--	11.64	--	Equal to following interval
	8.0-9.0	8.0-9.0	--	--	--	--	--	--	11.64	--	measured
	--	9.0-33	--	--	--	--	--	--	6.40	--	average[2]
	32.5-33.5	33-34	--	--	--	--	--	--	1.71	--	measured
	--	34-59	--	--	--	--	--	--	1.58	--	average[2]
	59-60	59-60	--	--	--	--	--	--	1.46	--	measured
	--	60-83	--	--	--	--	--	--	2.27	--	average[2]
	82-83	83-84	--	--	--	--	--	--	3.10	--	measured
	--	84-90	--	--	--	--	--	--	3.10	--	Equal to preceding depth intervals

Notes:
bgs = below ground surface
µg/kg = microgram per kilogram
-- = not applicable
[1] = EPA Soil Screening Guidance: User's Guide, Office of Solid Waste and Emergency Response, July 1996, EPA540/R-96/018.
[2] = The average of the concentrations in the preceding and following depth intervals.
[3] = Maximum of the "Maximum Predicted Concentration in Soil" for SVMW-1 and SVMW-2.
[4] =See Table 22 for explanation - Note[1]

Cs = Predicted Soil Concentration
> = greater than
EPA = United States Environmental Protection Agency
SVMW = soil vapor monitor well
ID = Identification

TABLE 23A
ESTIMATED TETRACHLOROETHENE CONCENTRATIONS IN SOIL USED IN VLEACH MODELING FOR EPA REQUESTED PARAMETERS

Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample ID	Sample Depth (feet bgs)	Model Depth (feet bgs)	Site-Specific Assumptions		Model Inputs		
			0 to 12 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	43 to 63 feet bgs Predicted Concentration in Soil (µg/kg) [Cs]	Maximum Predicted Concentration in Soil (µg/kg) [Cs]	Depth-Specific Concentration in Soil (µg/kg) [Cs]	Rationale
SVMW-1	--	0-8.0	--	--	4.91	4.91	Equal to following interval
	8.0-9.0	8.0-9.0	4.91	4.05	4.91	4.91	measured
	--	9.0-33	--	--	2.65	2.62	average (1)
	32.5-33.5	33-34	0.38	0.31	0.38	0.33	measured
	--	34-59	--	--	0.43	0.36	average
	59-60	59-60	0.48	0.39	0.48	0.39	measured
SVMW-2	--	0-8.0	--	--	1.42	1.42	Equal to following interval
	8.0-9.0	8.0-9.0	1.42	1.17	1.42	1.42	measured
	--	9.0-33	--	--	0.99	0.95	average
	32.5-33.5	33-34	0.56	0.46	0.56	0.49	measured
	--	34-59	--	--	0.51	0.44	average
	59-60	59-60	0.47	0.39	0.47	0.39	measured
MAXIMUM (2)	--	0-8.0	--	--	4.91	--	Equal to following interval
	8.0-9.0	8.0-9.0	--	--	4.91	--	measured
	--	9.0-33	--	--	2.65	--	average
	32.5-33.5	33-34	--	--	0.56	--	measured
	--	34-59	--	--	0.51	--	average
	59-60	59-60	--	--	0.48	--	measured

Notes:

bgs = below ground surface
µg/kg = microgram per kilogram
-- = not applicable
SVMW = soil vapor monitor well
ID = Identification
Cs = Predicted Soil Concentration
EPA = United States Environmental Protection Agency

(1) = The average of the concentrations in the preceding and following depth intervals.

(2) = Maximum of the "Maximum Predicted Concentration in Soil" for SVMW-1 and SVMW-2.

TABLE 24
CALCULATION OF TETRACHLOROETHENE CONCENTRATION IN GROUNDWATER USING SUMMER'S MODEL
Salt River Project's 16th Street Facility
Phoenix, Arizona

Representative Concentration Scenarios	Flux to GW (Jgw) (g/ft^2-yr)	PCE Concentration in GW (Cgw) (µg/L)	Flux to GW (Jgw) g/ft^2-yr	PCE Concentration in GW (Cgw) µg/L	Flux to GW (Jgw) g/ft^2-yr	PCE Concentration in GW (Cgw) µg/L	Flux to GW (Jgw) g/ft^2-yr	PCE Concentration in GW (Cgw) µg/L
	EPA Chemical Parameters for PCE		VLEACH Chemical Parameters for PCE		VLEACH Chemical Parameters for PCE		EPA Requested Chemical Parameters for PCE	
	foc = 0.005	DTGW = 90 ft	foc = 0.005	DTGW = 90 ft	foc = 0.005	DTGW = 90 ft	foc = 0.001	DTGW = 60 ft
	IR = 0.0875 ft/yr	MZT = 32.8 ft	IR = 0.0875 ft/yr	MZT = 32.8 ft	IR = 0.0875 ft/yr	MZT = 10 ft	IR = 0.0083 ft/yr	MZT = 10 ft
Drywell (SVMW-1, Depth-Specific)	6.92E-04	**0.057**	7.62E-04	**0.062**	7.62E-04	**0.205**	1.01E-03	**0.271**
Sump (SVMW-2, Depth-Specific)	7.08E-04	**0.116**	7.72E-04	**0.126**	7.72E-04	**0.414**	4.54E-04	**0.244**
Drain Pipe (Maximum PCE Concentrations)	8.96E-04	**0.018**	9.88E-04	**0.020**	9.88E-04	**0.065**	1.03E-03	**0.068**

Notes:

$$Cgw = \frac{Jgw * A * CF * CF1}{(Vgw * z * y) + (Vinf * A)}$$

See Table 25 for parameter descriptions.

GW = groundwater
g/ft^2-yr = grams per square foot per year
µg/L = microgram per liter
PCE = Tetrachloroethene
EPA = United Stated Environmental Protection Agency
SVMW = soil vapor monitor well
DTGW = depth to groundwater
IR = infiltration rate
MZT = mixing zone thickness
ft = feet
ft/yr = feet per year
foc = fraction of organic carbon

TABLE 25
MODELING PARAMETERS USED FOR SUMMER'S MODEL
Salt River Project's 16th Street Facility
Phoenix, Arizona

Summer's Model Parameter	Symbol	Units	Value	Rationale/Source
Groundwater Aquifer Properties				
Mixing Zone Thickness	z	foot	32.8	ADEQ Default, ADEQ, 1996*
Hydraulic Gradient	i	--	0.001	Calculated from groundwater elevations; Shaw, 2007*
Hydraulic Conductivity	K	ft/yr	65700	Low end of range for Salt River Gravels (180 ft/day); Shaw, 2005*
Groundwater Velocity	Vgw	ft/yr	65.7	(K)*(i)
Site Properties				
Flux rate to groundwater	Jgw	g/ft^2-yr	--	VLEACH modeling simulations
Area of Source 1 (Drywell)	A1	ft^2	25	Estimated drywell dimensions (5 ft x 5 ft)
Area of Source 2 (Sump)	A2	ft^2	50	Estimated sump/sewer interceptor grease trap dimensions (10 ft x 5 ft)
Area of Source 3 (Drain Pipe)	A3	ft^2	195	Estimated storm drain pipe dimensions (1 ft x 195 ft)
Width of Source 1 Perpendicular to Flow	y1	foot	5	5 ft x 5 ft source (Drywell)
Width of Source 2 Perpendicular to Flow	y2	foot	5	10 ft x 5 ft source (Sump/Sewer Interceptor Grease Trap)
Width of Source 3 Perpendicular to Flow	y3	foot	160	195 ft x 1 ft source (Storm Drain Pipe)
Infiltration Rate 1	Vinf1	ft/yr	0.0875	15% of 7 in/yr average rainfall
Conversion Factors				
Conversion Factor	CF	µg/g	1.00E+06	standard unit conversion
Conversion Factor 1	CF1	ft^3/L	0.0353	standard unit conversion
Additional Infiltration Rates for Sensitivity Analysis				
Infiltration Rate 2	Vinf2	ft/yr	0.029	5% of 7 in/yr average rainfall
Infiltration Rate 3	Vinf3	ft/yr	0.0058	1% of 7 in/yr average rainfall

Notes:

ft/yr = feet per year
ft^2 = square foot
in/yr = inches per year
ft/day = feet per day
ADEQ - Arizona Department of Environmental Quality
*Refer to Section 11.0 - References

µg/g = micrograms per gram
g/ft^2-yr = grams per square foot per year
ft^3/L = cubic foot per liter
% = percent
-- = not applicable
ft = feet

TABLE 26
SENSITIVITY ANALYSIS OF RECHARGE RATE AND POROSITY

Salt River Project's 16th Street Facility
Phoenix, Arizona

Representative Concentration	Flux to GW (Jgw) g/ft²-yr	PCE Concentration in GW (Cgw) µg/L	Flux to GW (Jgw) g/ft²-yr	PCE Concentration in GW (Cgw) µg/L	Flux to GW (Jgw) g/ft²-yr	PCE Concentration in GW (Cgw) µg/L
Scenario	**15% Infiltration Rate**		**5% Infiltration Rate**		**1% Infiltration Rate**	
Drywell (SVMW-1, Depth-specific)	6.9238E-04	**0.0567**	6.9079E-04	**0.0566**	6.9017E-04	**0.0565**
Sump (SVMW-2, Depth-specific)	7.0766E-04	**0.1159**	7.0604E-04	**0.1156**	7.0541E-04	**0.1155**
Drain Pipe (Maximum PCE Concentrations)	8.9647E-04	**0.0179**	8.9441E-04	**0.0179**	8.9366E-04	**0.0178**
Scenario	**Total Porosity = 0.373**		**Total Porosity +10% (0.410)**		**Total Porosity -10% (0.336)**	
Drywell (SVMW-1, Depth-specific)	6.9238E-04	**0.0567**	7.3153E-04	**0.0599**	6.5018E-04	**0.0532**
Sump (SVMW-2, Depth-specific)	7.0766E-04	**0.1159**	7.4365E-04	**0.1218**	6.6781E-04	**0.1093**
Drain Pipe (Maximum PCE Concentrations)	8.9647E-04	**0.0179**	9.4728E-04	**0.0189**	8.4165E-04	**0.0168**

Notes:

$$Cgw = \frac{Jgw * A * CF * CF1}{(Vgw * z * y) + (Vinf * A)}$$

See Table 25 for parameter descriptions.
% = percent
g/ft²-yr = grams per square foot per year
µg/L = microgram per liter
PCE = Tetrachloroethene
SVMW = soil vapor monitor well
GW = groundwater

TABLE 27
MODELING PARAMETERS FOR STAGE 1
Salt River Project's 16th Street Facility
Phoenix, Arizona

STAGE 1 MODEL				
Model Parameter		**Proposed Value**	**Units**	**Rationale/Source**
Site Properties and Physical Parameters				
Recharge Rate		0.0875	ft/yr	15% infiltration of annual average rainfall (7 inches per year).
Area of Drywell		1	ft^2	Calibration modeling, designed to be dependent on starting soil concentration.
Area of Sump/ Sewer Interceptor Grease Trap		1	ft^2	Calibration modeling, designed to be dependent on starting soil concentration.
Total Porosity		0.42	--	Average soil property for the fine grained unit measured during the installation of SVMW-1 and SVMW-2.
Irreducible water content		0.045 to 0.1	--	The percentage of the total volume which is retained due to capillary forces; Ravi and Johnson, 1997, Appendix B*; values selected based on soil type.
Effective Porosity		0.334	--	Effective porosity is the total porosity minus the irreducible water content. Value was calculated with the harmonic mean of the depth-specific porosities that were measured during the installation of SVMW-1 and SVMW-2, the two soil borings advanced as part of the Phase II Remedial Investigation and values selected based on soil type.
Volumetric Water Content		0.23	--	The harmonic mean of soil properties for the fine grained unit measured during the installation of SVMW-1 and SVMW-2 and the soil borings advanced during the Phase II Remedial Investigation.
Fraction Organic Carbon (FOC)		0.005	--	The FOC value is based on the analytical results for site specific total organic carbon (TOC) in soil samples collected during the installation of SVMW-1, SVMW-2, and the two borings advanced during the Phase II Remedial Investigation.
Dry Bulk Density		1.77	g/cm^3	Average soil property for the fine grained unit measured during the installation of SVMW-1 and SVMW-2.
Model Parameters				
Soil Column		13	ft	The approximate depth of the upper fine-grained unit.
Vertical Cell Thickness		1	ft	Professional judgment.
Time Step Length		0.1	years	Professional judgment.
Simulation Time		33	years	The simulation time for the Stage I modeling is calculated by taking the year that solvent use ceased and subtracting that from current day (2008-1975).
Upper Boundary Condition for Vapor	Sump	-1	mg/L	Assumes top of soil layer is impermeable to atmospheric diffusion because of pavement.
	Drywell	0	mg/L	Assumes top of soil layer is permeable to atmospheric diffusion.
Lower Boundary Condition for Vapor		0	mg/L	Conservative assumption; overestimates diffusion into saturated zone. However, in the Stage I modeling, only (unsaturated) vadose zone soil is being modeled, so downward vapor diffusion is appropriate.
PCE Chemical Properties				
Water Solubility		660.69	mg/L	Ravi and Johnson, 1997, Appendix A*
Organic Carbon Partition Coefficient		150	mL/g	Ravi and Johnson, 1997, Appendix A*
Henry's Law Constant (dimensionless)		0.92	--	Ravi and Johnson, 1997, Appendix A*
Free air diffusion coefficient		0.62	m^2/d	EPA, 2004c*

Notes:

ft = foot
ft^2 = square foot
ft/yr = feet per year
m^2/d = square meter per day
*Refer to Section 11.0 - References
PCE = Tetrachloroethene

mg/L = milligrams per liter
g/cm^3 = grams per cubic centimeter
mL/g = milliliters per gram
% = percent
-- = unitless
(-) = negative

SVMW = soil vapor monitor well
EPA = United States Environmental Protection Agency

TABLE 28
MODELING PARAMETERS FOR STAGE 2
Salt River Project's 16th Street Facility
Phoenix, Arizona

STAGE 2 MODEL				
Model Parameter		**Proposed Value**	**Units**	**Rationale/Source**
Site Properties and Physical Parameters				
Recharge Rate		0.0875	ft/yr	15% infiltration of annual average rainfall (7 inches per year).
Area of Drywell		1	ft^2	Based on a unit area, consistent with Stage I modeling.
Area of Sump/ Sewer Interceptor Grease Trap		1	ft^2	Based on a unit area, consistent with Stage I modeling.
Total Porosity		0.38	--	Soil properties measured during the installation of SVMW-1 and SVMW-2 and obtained from the visual inspection of the soils.
Irreducible water content		0.045 to 0.1	--	The percentage of the total volume which is retained due to capillary forces; Ravi and Johnson, 1997, Appendix B*; values selected based on soil type.
Effective Porosity		0.313 (for 60 ft modeled soil column)	--	Effective porosity is the total porosity minus the irreducible water content. Value was calculated with the harmonic mean of the depth-specific porosities that were measured during the installation of SVMW-1 and SVMW-2, the two soil borings advanced as part of the Phase II Remedial Investigation and values selected based on soil type.
		0.31 (for 90 ft modeled soil column)	--	
Volumetric Water Content		0.186 (for 60 ft modeled soil column)	--	The depth discrete harmonic mean of soil properties measured during the installation of SVMW-1 and SVMW-2 and the soil borings advanced during the Phase II Remedial Investigation.
		0.176 (for 90 ft modeled soil column)	--	
Fraction Organic Carbon (FOC)		0.005	--	The FOC value is based on the analytical results for site specific total organic carbon (TOC) in soil samples collected during the installation of SVMW-1, SVMW-2, and the two borings advanced during the Phase II Remedial Investigation.
Dry Bulk Density		1.77	g/cm^3	Average soil property for the soil column measured during the installation of SVMW-1 and SVMW-2 and the soil borings advanced during the Phase II Remedial Investigation.
Model Parameters				
Soil Column Thickness		60-90	ft	Depends on the varying water table throughout the 45 year time period.
Vertical Cell Thickness		1	ft	Professional judgment.
Time Step Length		0.1	years	Professional judgment.
Simulation Time		45	years	The simulation time for the Stage II modeling is calculated by taking the year of initial solvent use and subtracting that from current day (2008-1964).
Upper Boundary Condition for Vapor	Sump	-1	mg/L	Assumes top of soil layer is impermeable to atmospheric diffusion because of pavement.
	Drywell	0	mg/L	Assumes top of soil layer is permeable to atmospheric diffusion.
Lower Boundary Condition for Vapor		-1 or 0	mg/L	Assumes that the water table provides a complete barrier to solvent transport to the water (-1) or that water table is permeable to downward vapor migration (0).
PCE Chemical Properties				
PCE Water Solubility		660.69	mg/L	Ravi and Johnson, 1997, Appendix A*
Organic Carbon Partition Coefficient		150	mL/g	Ravi and Johnson, 1997, Appendix A*
Henry's Law Constant (dimensionless)		0.92	--	Ravi and Johnson, 1997, Appendix A*
Free air diffusion coefficient		0.62	m^2/d	EPA, 2004c*

Notes:

ft = foot
ft^2 = square foot
ft/yr = feet per year
m^2/d = square meter per day
mg/L = milligrams per liter
g/cm^3 = grams per cubic centimeter
EPA = United States Environmental Protection Agency
(-) = negative

* = Refer to Section 11.0 - References
mL/g = milliliters per gram
% = percent
-- = unitless
FOC = Fraction of Organic Carbon
SVMW = soil vapor monitor well
PCE = Tetrachloroethene

TABLE 29
MODELING PARAMETERS FOR SUMMER'S MODEL
Salt River Project's 16th Street Facility
Phoenix, Arizona

Summer's Model Parameter	Units	Value	Rationale/Source
Groundwater Aquifer Properties			
Mixing Zone Thickness	ft	32.8, 60, & 100	Arizona Department of Environmental Quality Default (32.8 ft); approximate conservative historical thickness used by other sites within the OU3 area (60 ft); and conservative estimate of aquifer thickness (100 ft) based on well log information in vicinity.
Hydraulic Gradient (i)	--	0.001	Calculated from groundwater elevations; Shaw, 2007*
Hydraulic Conductivity (K)	ft/yr	65,700	Low end of range for Salt River Gravels (180 ft/day); Shaw, 2005*
Groundwater Velocity	ft/yr	65.7	(K)*(i)
Site Properties			
Flux rate to groundwater	g/ft^2-yr	---	VLEACH modeling simulations
Area of Source 1	ft^2	25	Estimated drywell dimensions (5 ft x 5 ft)
Area of Source 2	ft^2	50	Estimated sump/sewer interceptor grease trap dimensions (5 ft x 10 ft)
Width of Source 1	ft	5	5 ft x 5 ft source (drywell)
Width of Source 2	ft	5	5 ft x 10 ft source (sump/sewer interceptor grease trap)
Infiltration Rate 1	ft/yr	0.0875	15% of 7 in/yr average rainfall
Conversion Factors			
Conversion Factor	µg/g	1.00E+06	Standard unit conversion
Conversion Factor 1	ft^3/L	0.0353	Standard unit conversion

Notes:

ft = foot
ft^2 = square foot
in/yr = inches per year
ft/day = feet per day
% = percent
*Refer to Section 11.0 - References

ft/yr = feet per year
µg/g = micrograms per gram
g/ft^2-yr = grams per square foot per year
ft^3/L = cubic foot per liter
OU3 = Operable Unit 3

TABLE 30
STAGE 1 - PCE SOURCE CONCENTRATION CALIBRATION
MODEL RESULTS

Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample ID	Sample Depth (ft bgs)	MEASURED SOIL VAPOR CONCENTRATIONS Maximum (mg/m^3)	Modeled Sample Depth (ft bgs)	PREDICTED SOIL VAPOR CONCENTRATIONS WITH DESCRIBED INPUT PARAMETERS[1]	
				Stage 1 Model Parameters	Drywell / Sump
				Derivation of Soil Properties	harmonic / harmonic
				Soil Column Depth	13 ft / 13 ft
				Modeled Initial Soil Concentration	1,545 µg/kg / 42 µg/kg
				Modeled Source Release Depths	10-13 ft bgs / 5-12 ft bgs
				Paved or Unpaved	Unpaved / Paved
				Fraction Organic Content (f_{oc})	0.005
SVMW-1 (Drywell)	8.0-9.0	7.5	8.0	Predicted Soil Vapor Concentrations (mg/m^3) →	17.799
	32.5-33.5	0.75	33		na
	59-60	0.94	60		na
	82.5-83.5	1.9	83		na
SVMW-2 (Sump)	8.0-9.0	2.8	8.0		2.767
	32.5-33.5	1.1	33		na
	59-60	0.93	60		na
	82-83	2	83		na

Sample ID	Sample Depth (ft bgs)	MEASURED SOIL CONCENTRATIONS Maximum (µg/kg)	Modeled Sample Depth (ft bgs)	PREDICTED SOIL CONCENTRATIONS WITH DESCRIBED INPUT PARAMETERS[1]	
				Stage 1 Model Parameters	Drywell / Sump
				Derivation of Soil Properties	harmonic / harmonic
				Soil Column Depth	13 ft / 13 ft
				Modeled Initial Soil Concentration	1,545 µg/kg / 42 µg/kg
				Modeled Source Release Depths	10-13 ft bgs / 5-12 ft bgs
				Paved or Unpaved	Unpaved / Paved
				Fraction Organic Content (f_{oc})	0.005
SVMW-1 (Drywell)	5	1.8	5.0	Predicted Soil Concentrations (µg/kg) →	43.094
	11	66	11		66.074
SVMW-2 (Sump)	5	<2.0	5.0		11.040
	13	<9.7	13		2.141

Notes:

[1] = Stage 1 modeling used to calibrate modeled initial soil concentrations by comparing predicted soil vapor concentrations to measured soil vapor and/or soil concentrations.

PCE = Tetrachloroethene
mg/m^3 = milligrams per cubic meter
ft bgs = feet below ground surface
µg/kg = micrograms per kilogram
ft = feet
ID = Identification
< = less than
na = not applicable

TABLE 30A
STAGE 1 - PCE SOURCE CONCENTRATION CALIBRATION MODEL RESULTS
FOR EPA REQUESTED PCE CONCENTRATION
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample ID	Sample Depth (ft bgs)	MEASURED SOIL VAPOR CONCENTRATIONS: EPA Requested Value (mg/m^3)	MEASURED SOIL VAPOR CONCENTRATIONS: Maximum (mg/m^3)	Modeled Sample Depth (ft bgs)	PREDICTED SOIL VAPOR CONCENTRATIONS WITH DESCRIBED INPUT PARAMETERS[1]								
						Drywell	Sump	Drywell	Sump	Drywell	Sump	Drywell	Sump
					Derivation of soil properties	harmonic	harmonic	harmonic	harmonic	harmonic	harmonic	harmonic	harmonic
					Soil Column Depth	13 ft	13ft	13 ft	13ft	13 ft	13ft	13 ft	13ft
					Modeled Initial Soil Concentration	1,545 µg/kg	42 µg/kg	15,450 µg/kg	84 µg/kg	154,500 µg/kg	95 µg/kg	81,315 µg/kg	105 µg/kg
					Modeled Source Release Depths	10-13 ft bgs	5-12 ft bgs	10-13 ft bgs	5-12 ft bgs	10-13 ft bgs	5-12 ft bgs	10-13 ft bgs	5-12 ft bgs
					Paved or Unpaved	Unpaved	Paved	Unpaved	Paved	Unpaved	Paved	Unpaved	Paved
					Fraction Organic Content (f_{oc})	0.001		0.001		0.001		0.001	
SVMW-1 (Dry Well)	8.0-9.0	9.70	7.5	8.0	Predicted Soil Vapor Concentrations (mg/m^3)	0.186		1.858		18.576		9.777	
	32.5-33.5	na	0.75	33		na		na		na		na	
	59-60	na	0.94	60		na		na		na		na	
	82.5-83.5	na	1.9	83		na		na		na		na	
SVMW-2 (Sump)	8.0-9.0	na	2.8	8.0		1.086		2.173		2.457		2.716	
	32.5-33.5	na	1.1	33		na		na		na		na	
	59-60	na	0.93	60		na		na		na		na	
	82-83	na	2	83		na		na		na		na	

Sample ID	Sample Depth (ft bgs)	MEASURED SOIL CONCENTRATIONS: Maximum (µg/kg)	Modeled Sample Depth (ft bgs)	PREDICTED SOIL CONCENTRATIONS WITH DESCRIBED INPUT PARAMETERS[1]								
					Drywell	Sump	Drywell	Sump	Drywell	Sump	Drywell	Sump
				Derivation of soil properties	harmonic	harmonic	harmonic	harmonic	harmonic	harmonic	harmonic	harmonic
				Soil Column Depth	13 ft	13ft	13 ft	13ft	13 ft	13ft	13 ft	13ft
				Modeled Initial Soil Concentration	1,545 µg/kg	42 µg/kg	15,450 µg/kg	84 µg/kg	154,500 µg/kg	95 µg/kg	121,800 µg/kg	1,135 µg/kg
				Modeled Source Release Depths	10-13 ft bgs	5-12 ft bgs	10-13 ft bgs	5-12 ft bgs	10-13 ft bgs	5-12 ft bgs	10-13 ft bgs	5-12 ft bgs
				Paved or Unpaved	Unpaved	Paved	Unpaved	Paved	Unpaved	Paved	Unpaved	Paved
				Fraction Organic Content (f_{oc})	0.001		0.001		0.001		0.001	
SVMW-1 (Dry Well)	5	1.8	5.0	Predicted Soil Concentrations (µg/kg)	0.096		0.958		9.581		5.043	
	11	66	11		0.067		0.469		6.715		3.534	
SVMW-2 (Sump)	5	<2.0	5.0		0.957		1.915		2.166		2.394	
	13	<9.7	13		0.130		0.260		0.295		0.326	

Notes:

[1] = Stage 1 modeling used to calibrate modeled initial soil concentrations by comparing predicted soil vapor concentrations to measured soil vapor and/or soil concentrations.

PCE = tetrachloroethene
mg/m^3 = milligrams per cubic meter
ft bgs = feet below ground surface
µg/kg = micrograms per kilogram
ft = feet
ID = Identification
< = less than
na = not applicable

TABLE 31
HISTORICAL SOIL AND SOIL GAS DATA FOR STAGE 1 MODELING CALIBRATION
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample Year	Sample ID	Sample Matrix	PCE[1]	PCE (ppm)	Modeled PCE Concentration[4] (ppm)	Approximate Distance from SVMWs (feet)	
1989	Unknown[2]	Soil	<50 µg/L[3]	< 0.05	0.018 to 0.02	~25	NW of SVMW-2
1989	Unknown[2]	Soil	<50 µg/L[3]	< 0.05	0.075 to 0.115	~25	NE of SVMW-1
1990	SI 16DW2-A (3 to 6' bgs)	Sediment	<500 µg/kg	< 0.5	0.042 to 0.093	~110	NE of SVMW-1
1990	SI 16DW2-B (8 to 12' bgs)	Sediment	<500 µg/kg	< 0.5	0.134 to 0.294		
1990	SI 16DW2-C (12 to 13' bgs)	Sediment	<500 µg/kg	< 0.5	0.294 to 0.237		
1990	16ST Trench-Sub grade	Soil	<250 µg/kg	<0.25	0.013 to 0.32	~80	NE of SVMW-1
2002	SG-15-1'	Vapor	0.02 ppmv	0.02	0.013	~25	SW of SVMW-2
2002	SG-15-4'	Vapor	0.06 ppmv	0.06	0.014		

Notes:

[1] = PCE concentration as reported in laboratory analytical reports presented in Research Report (SRP, 2004) - Refer to Section 11.0 - References.

[2] = Samples were generally collected from 5 to 7 feet below ground surface.

[3] = The analytical results for the soil samples were originally reported in units of µg/L. Since the units reported for the analytical results of PCE in the soil samples are inconsistent with typical reporting units of mg/kg, AMEC Geomatrix has assumed that units are equivalent to parts per billion, which was converted to ppm.

[4] = Modeled PCE Concentrations from Stage 2 VLEACH .prf file (Appendix G).

Shaded PCE concentration is converted from reported units to ppm.

PCE = Tetrachloroethene
bgs = below ground surface
ppm = parts per million
< = Analyte not detected at concentration greater than the reporting limit shown.
µg/L = microgram per liter
µg/kg = microgram per kilogram
ppmv = parts per million by volume
SVMW = soil vapor monitor well
NW = Northwest
NE = Northeast
SW = Southwest
ID = identification
~ = approximate

TABLE 32
STAGE 2 - GREATEST PREDICTED PCE GROUNDWATER CONCENTRATIONS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Depth to Groundwater (ft bgs)	Aquifer Thickness (ft)	Initial Modeled Soil Concentration [2] (µg/kg)		Modeled Source Depths (ft bgs)		Paved/Unpaved		Greatest Modeled Groundwater Concentration [1] (µg/L)	Comments
		Drywell	Sump	Drywell	Sump	Drywell	Sump		
60	10	1,545	42	10-13	5-12	Unpaved	Paved	0.014	Section 7.5.2
60	32.8	1,545	42	10-13	5-12	Unpaved	Paved	0.004	Section 7.4.4
60	60	1,545	42	10-13	5-12	Unpaved	Paved	0.002	
60	100	1,545	42	10-13	5-12	Unpaved	Paved	0.001	
90	10	1,545	42	10-13	5-12	Unpaved	Paved	0.00078	Section 7.5.2
90	32.8	1,545	42	10-13	5-12	Unpaved	Paved	0.00024	Section 7.4.4
90	60	1,545	42	10-13	5-12	Unpaved	Paved	0.00013	
90	100	1,545	42	10-13	5-12	Unpaved	Paved	0.00008	
60	32.8	1,545	42	10-13	5-12	Unpaved	Paved	0.00088	Section 7.5.1 - Best Case
60	60	1,545	42	10-13	5-12	Unpaved	Paved	0.00048	
60	100	1,545	42	10-13	5-12	Unpaved	Paved	0.00029	
90	32.8	1,545	42	10-13	5-12	Unpaved	Paved	0.000057	
90	60	1,545	42	10-13	5-12	Unpaved	Paved	0.000031	
90	100	1,545	42	10-13	5-12	Unpaved	Paved	0.000019	
60	32.8	2,317.5	63	10-13	5-12	Unpaved	Paved	0.0063	Section 7.5.1 - Worse Case
60	60	2,317.5	63	10-13	5-12	Unpaved	Paved	0.0034	
60	100	2,317.5	63	10-13	5-12	Unpaved	Paved	0.0021	
90	32.8	2,317.5	63	10-13	5-12	Unpaved	Paved	0.0004	
90	60	2,317.5	63	10-13	5-12	Unpaved	Paved	0.00019	
90	100	2,317.5	63	10-13	5-12	Unpaved	Paved	0.00012	
60	10	81,315	105	10-13	5-12	Unpaved	Paved	1.20	Section 7.5.3

Notes:
[1] = Modeled time period is 1965 through 2008.
[2] = Initial modeled soil concentration varies based on assumed percent of spilled volume (see Table 33).
PCE = Tetrachloroethene
ft bgs = feet below ground surface
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
ft = feet

TABLE 33
SUMMARY OF TETRACHLOROETHENE USAGE AND SPILL SCENARIOS
Salt River Project's 16th Streeet Facility
Phoenix, Arizona

Operation	Location	COCs Used	Container Type	Approximate Volume Used (gallons/year)	Percent PCE (%)[2]	Approximate Volume PCE Used (gallons/year)	Number of Years Used (years)	Total Approximate Volume Used (gallons)	Total Approximate Volume PCE Used (gallons)	Start Use	End Use
Transportation Garage	Building 37	SS-25 (PCE)[1]	55-gallon	360	35%	126	5	1,800	630	1967	1971
Transportation Garage	Building 37	SS-25 (PCE)[1]	55-gallon	180	35%	63	4	720	252	1972	1975
Repair Garage	Building 11	SS-25 (PCE)[1]	55-gallon	1,140	35%	399	4	4,560	1,596	1972	1975
Repair Garage	Building 11	SS-25 (PCE)[1]	55-gallon	1,320	35%	462	2	2,640	924	1971	1972
Heavy Duty Garage	Building 34	SS-25 (PCE)[1]	55-gallon	1,440	35%	504	4	5,760	2,016	1972	1975
Paint and Body Shop	Building 11 (Wing)	SS-25 (PCE)[1]	55-gallon	360	35%	126	3	1,080	378	1972	1974
Electric Shop	Building 3	SS-25 (PCE)[1]	55-gallon	700	35%	245	11	7,700	2,695	1964	1974

Year	Total PCE Used (gallons)	1% Spill (Gallons)	Monthly Spill Scenario [1/12th of 1% Spill] (gallons)	Total Mass of Spill (grams)[3]	Assumed Release for Drywell (grams)	Drywell Release Concentration to Model (µg/kg)	Assumed Release for Sewer Interceptor (grams)	Sewer Interceptor Concentration to Model (µg/kg)
1964	245	2.45	0.20	1,254	1,221.0	348,440	33.19	2,030
1965	245	2.45	0.20	1,254	1,221.0	348,440	33.19	2,030
1966	245	2.45	0.20	1,254	1,221.0	348,440	33.19	2,030
1967	371	3.71	0.31	1,899	1,849.0	527,638	50.26	3,074
1968	371	3.71	0.31	1,899	1,849.0	527,638	50.26	3,074
1969	371	3.71	0.31	1,899	1,849.0	527,638	50.26	3,074
1970	371	3.71	0.31	1,899	1,849.0	527,638	50.26	3,074
1971	833	8.33	0.69	4,264	4,151.4	1,184,697	112.9	6,901
1972	1,799	17.99	1.50	9,209	8,965.7	2,558,547	243.7	14,904
1973	1,337	13.37	1.11	6,844	6,663.3	1,901,488	181.1	11,077
1974	1,337	13.37	1.11	6,844	6,663.3	1,901,488	181.1	11,077
1975	966	9.66	0.81	4,945	4,814.3	1,373,850	130.9	8,003

TABLE 33
SUMMARY OF TETRACHLOROETHENE USAGE AND SPILL SCENARIOS
Salt River Project's 16th Streeet Facility
Phoenix, Arizona

Ratio of Mass Release between Drywell and Sewer Interceptor

Drywell Calibrated Source Concentration =	1,545	µg/kg
Sewer Interceptor Calibrated Source Concentration =	42	µg/kg

Ratio of calculated mass release between drywell and sewer interceptor =	0.97	drywell
	0.03	sewer interceptor

Estimated Mass of Soil in Modeled Release Volume

Modeled Sump Impacted Release Volume* =	350	ft^3	9,911	L	16,353	kg of soil in volume
Modeled Drywell Impacted Release Volume** =	75	ft^3	2,124	L	3,504	kg of soil in volume
Modeled Soil Bulk Density =	1.65	g/cm^3	1.65	kg/L		

Notes:

PCE = tetrachloroethene
bgs = below ground surface
ft^3 = cubic feet
kg = kilograms
L = liters
µg/kg = microgram per kilogram
g/cm^3 = grams per cubic centimeter
kg/L = kilogram per liter
mL/L = milliliter per liter
g/mL = gram per milliliter
% = percent

(1) = Assume all SS-25 used.
(2) = Percent of PCE based on material safety data sheet for SS-25 (Appendix I).
(3) = Grams PCE = (gallons PCE)*(3.785 L/gallon)*(1,000 mL/L)*(1.623 g/mL)
* Assumes 5 feet long by 10 feet wide and a modeled release point from 5-12 feet bgs.
** Assumes 5 feet long by 5 feet wide and a modeled release point from 10-13 feet bgs.
Density of PCE = 1.623 g/mL

TABLE 34
CHEMICALS DETECTED IN EACH MEDIA

Salt River Project's 16th Street Facility
Phoenix, Arizona

Chemical	Detected in Active Soil Gas Samples[1] (MDL Range in µg/m^3)	Detected in Outdoor Samples[2] (MDL Range in µg/m^3)	Detected in Indoor Air Samples[2] (MDL Range in µg/m^3)	Detected in Perimeter Samples[2] (MDL Range in µg/m^3)
Tetrachloroethene*	**Yes (<3.4 - 9,700)**	**Yes (0.15 - 0.60)**	**Yes (<0.025 - 1.0)**	**Yes (0.13 - 0.25)**
Trichloroethene*	**Yes (<2.8 - <1,100 J)**	**Yes (0.05 - 0.29)**	**Yes (<0.01 - 0.40)**	**Yes (0.04 - 0.07)**
Chloroethane/Ethyl Chloride*	No (<1.3 - <540 J)	**Yes (<0.15 - 0.19)**	No (<0.15 - <0.22)	No (<0.14 - <0.31)
1,1-Dichloroethane*	No (<2.1 - <820 J)	No (<0.14 - <0.18)	No (<0.1 - <0.22)	No (<0.14 - <0.31)
1,2-Dichloroethane*	No (<2.1 - <820 J)	**Yes (<0.035 - 0.046)**	**Yes (<0.025 - 0.17)**	No (<0.036 - <0.077)
1,1-Dichloroethene*	No (<2 - <810 J)	No (<0.14 - <0.18)	**Yes (<0.1 - 3.8)**	No (<0.14 - <0.31)
cis-1,2-Dichloroethene*	**Yes (<2 - <800 J)**	No (<0.14 - <0.18)	No (<0.1 - <0.22)	No (<0.14 - <0.31)
trans-1,2-Dichloroethene*	No (<2 - <800 J)	No (<0.14 - <0.18)	No (<0.1 - <0.22)	No (<0.14 - <0.31)
1,1,1-Trichloroethane*	**Yes (<2.8 - <1,100 J)**	No (<0.14 - <0.18)	**Yes (<0.1 - 2.7)**	No (<0.14 - <0.31)
1,1,2-Trichloroethane*	No (<2.8 - <1,100 J)	No (<0.14 - <0.18)	No (<0.1 - <0.22)	No (<0.14 - <0.31)
Vinyl Chloride*	No (<1.3 - <520 J)	No (<0.014 - <0.018)	No (<0.01 - <0.022)	No (<0.014 - <0.031)
1,4-Dioxane*	No (<18 - <920 UJ)	No (<0.14 - <0.18)	**Yes (<0.1 - 0.19)**	No (<0.14 - <0.31)
1,2,4-Trichlorobenzene	**Yes (<7.5 - 900,000 J)**	No (<0.14 - <0.18)	No (<0.1 - <0.22)	No (<0.14 - <0.31)
1,2,4-Trimethylbenzene	**Yes (<2.5 - 1,300 J)**	**Yes (0.48 - 1.0)**	**Yes (<0.1 - 3.2)**	**Yes (0.35 - 0.39)**
1,2-Dichlorobenzene	**Yes (<3.1 - 210,000 J)**	No (<0.14 - <0.18)	No (<0.1 - <0.22)	No (<0.14 - <0.31)
1,3-Dichlorobenzene	**Yes (<3.1 - 9,800 J)**	No (<0.14 - <0.18)	No (<0.1 - <0.22)	No (<0.14 - <0.31)
1,4-Dichlorobenzene	**Yes (<3.1 - 130,000 J)**	**Yes (0.38 - 1.1)**	**Yes (<0.1 - 1.7)**	**Yes (0.66 J - 1.6 J)**
Benzene	**Yes (<1.6 - <650 J)**	**Yes (0.82 - 1.7)**	**Yes (<0.1 - 3.7)**	**Yes (0.8 - 1.40)**
Ethylbenzene	**Yes (<2.2 - <880 J)**	**Yes (0.64 - 1.2)**	**Yes (<0.1 - 3.8)**	**Yes (0.58 - 1.3)**
Chlorobenzene	**Yes (<2.4 - 2,100 J)**	No (<0.15 - <0.18)	**Yes (<0.15 - 0.54)**	No (<0.14 - <0.31)
Chloroform	**Yes (<2.5 - <990 J)**	No (<0.14 - <0.18)	**Yes (<0.1 - 0.49)**	No (<0.14 - <0.31)

Notes:

Bold values indicate detects.

* Site Contaminants of Concern (COCs).

µg/m^3 = micrograms per cubic meter

MDL = Method Detection Limit

J = Analyte detected, reported concentration is an estimate.

UJ = Analyte was not detected above the reported sample quantitation limit, which is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte on the sample.

[1] = Refer to Tables 16A and 16B for analytical results of active soil gas sampling events conducted in November 2005 and June 2006.

[2] = Refer to Table 35 and Final Indoor Air Quality Report (Geomatrix, 2007e) for results of the IAQ sampling events conducted in March and September 2007.

< = Analyte not detected at concentration greater than the reporting limit shown.

TABLE 35
RESULTS FOR JOHNSON AND ETTINGER MODEL
Salt River Project's 16th Street Facility
Phoenix, Arizona

HEALTH RISK ASSESSMENT CALCULATIONS FOR SOIL GAS

Chemical [1]	Maximum Concentration Excluding Formerly Rejected Values				Maximum Concentration Including Formerly Rejected Values			
	Location of Maximum Concentration	Maximum Concentration Detected in Soil Gas (µg/L)	Incremental Risk from Vapor Intrusion to Indoor Air, Carcinogens (unitless)	Hazard Quotient from Vapor Intrusion to Indoor Air, Noncarcinogens (unitless)	Location of Maximum Concentration	Maximum Concentration Detected in Soil Gas (µg/L)	Incremental Risk from Vapor Intrusion to Indoor Air, Carcinogens (unitless)	Hazard Quotient from Vapor Intrusion to Indoor Air, Noncarcinogens (unitless)
Tetrachloroethene*	ASG-5-12	9.7	5.4E-06	4.3E-03	ASG-5-12	9.7	5.4E-06	4.3E-03
Tetrachloroethene* [2]	ASG-5-12	9.7	5.4E-06	7.3E-02	ASG-5-12	9.7	5.4E-06	7.3E-02
Trichloroethene*	ASG-21-15	0.27	2.9E-06	1.9E-03	ASG-21-15	0.27	2.9E-06	1.9E-03
Trichloroethene* [2]	ASG-21-15	0.27	5.3E-08	1.2E-04	ASG-21-15	0.27	5.3E-08	1.2E-04
1,1,1-Trichloroethane*	ASG-11-13	0.017	NA	2.1E-06	ASG-11-13	0.017	NA	2.1E-06
1,2,4-Trichlorobenzene	ASG-4-13.5	44	NA	1.8E+00	ASG-4C-05 [3]	900	NA	3.6E+01
1,2,4-Trimethylbenzene	ASG-9-11	0.1	NA	4.1E-03	ASG-4C-05 [3]	1.3	NA	5.3E-02
1,3,5-Trimethylbenzene	ASG-25-5	0.015	NA	6.1E-04	ASG-25-5	0.015	NA	6.1E-04
1,2-Dichlorobenzene	ASG-4-13.5	4.3	NA	5.6E-03	ASG-4C-05 [3]	210	NA	2.7E-01
1,3-Dichlorobenzene	ASG-4-13.5	0.13	NA	3.2E-04	ASG-4C-05 [3]	9.8	NA	2.4E-02
1,4-Dichlorobenzene	ASG-4-13.5	1.9	NA	6.2E-04	ASG-4C-05 [3]	130	NA	4.2E-02
Methyl Ethyl Ketone (2-butanone)	ASG-19-5	0.22	NA	1.2E-05	ASG-19-5	0.22	NA	1.2E-05
Acetone	ASG-18-14	2	NA	1.9E-03	ASG-18-14	2	NA	1.9E-03
Benzene	ASG-26-5	0.21	1.7E-07	2.0E-03	ASG-26-5	0.21	1.7E-07	2.0E-03
Carbon disulfide	ASG-17-12	0.11	NA	4.9E-05	ASG-17-12	0.11	NA	4.9E-05
Chlorobenzene	--	ND	NA	2.1E-04	ASG-4C-05 [3]	2.1	NA	9.4E-03
Chloroform	ASG-22-14	0.13	3.3E-07	NA	ASG-22-14	0.13	3.3E-07	NA
cis-1,2-Dichloroethylene	ASG-21-15	0.08	NA	6.1E-04	ASG-21-15	0.08	NA	6.1E-04
Cyclohexane	ASG-21-5	0.077	NA	3.9E-06	ASG-21-5	0.077	NA	3.9E-06
Dichlorodifluoromethane	ASG-10-15	0.031	NA	3.9E-05	ASG-10-15	0.031	NA	3.9E-05
Ethylbenzene	ASG-21-5	0.33	NA	8.9E-05	ASG-21-5	0.33	NA	8.9E-05
Heptane	ASG-21-5	0.19	NA	3.0E-06	ASG-21-5	0.19	NA	3.0E-06
Hexane	ASG-22-5	0.19	NA	3.6E-04	ASG-22-5	0.19	NA	3.6E-04
Methylene chloride	ASG-26-5	0.095	4.9E-09	9.7E-06	ASG-26-5	0.095	4.9E-09	9.7E-06
m&p-Xylene	ASG-21-5	1.1	NA	3.0E-03	ASG-21-5	1.1	NA	3.0E-03
o-Xylene	ASG-21-5	0.3	NA	8.6E-04	ASG-21-5	0.3	NA	8.6E-04
Styrene	ASG-2-15	0.039	NA	1.0E-05	ASG-2-15	0.039	NA	1.0E-05
Toluene	ASG-21-5	0.28	NA	1.6E-05	ASG-21-5	0.28	NA	1.6E-05
Trichlorofluoromethane (F-11)	ASG-27-13.0	0.049	NA	2.0E-05	ASG-27-13.0	0.049	NA	2.0E-05
Total Using EPA Toxicity Criteria			8.8E-06	1.8E+00	Total Using EPA Toxicity Criteria		8.8E-06	3.6E+01
Total Using Cal-EPA Toxicity Criteria			6.0E-06	1.8E+00	Total Using Cal-EPA Toxicity Criteria		6.0E-06	3.6E+01

Notes:

* Site Contaminants of Concern (COCs).

[1] = The following chemicals were detected at least once in soil gas but were not included by EPA in the Johnson & Ettinger model and are not evaluated herein: ethyl acetate (0.3 µg/L), 4-ethyltoluene (0.049 µg/L), 2-hexanone (0.025 µg/L), propene (0.61 µg/L for the originally rejected results and 1.0 µg/L for the originally rejected and now flagged results), and 2,2,4-trimethylpentane (0.85 µg/L). These represent the maximum detected concentrations.

[2] = Results for alternative evaluation of PCE and TCE using Cal-EPA toxicity criteria.

[3] = Tracer compound 1,1-difluoroethane was detected in samples, and the associated analytical results were rejected using the previous guidance (EPA, 1999), however, using recent guidance (EPA, 2007), the data are now flagged as estimated. These values were maximum detected concentration in soil gas samples.

EPA, 1999, Contract Laboratory Program National Functional Guidelines for Organic Data Review (OSWER 9240.1-05A-P PB99-963506, EPA 540/R-99-008), October.

EPA, 2007, Final Project Report for the Development of an Active Soil Gas Sampling Method, EPA/600/R-07/076, July.

EPA = United States Environmental Protection Agency
Cal-EPA = California Environmental Protection Agency
ND = Not detected above the laboratory minimum detection limit.
µg/L = micrograms per liter
ASG = active soil gas boring
NA = not applicable
m&p = meta & para
o = ortho

TABLE 36
INDOOR, OUTDOOR, AND PERIMETER AIR QUALITY SAMPLING RESULTS - DETECTED COMPOUNDS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample Date: March 2, 2006		Chemical Constituents Detected Concentration (µg/m^3)											
Sample ID	**Location of Sample**	**Benzene**	**PCE***	**TCE***	**Chloroethane/ Ethyl Chloride***	**1,2-DCA***	**1,1-DCE/VDC***	**1,1,1-TCA***	**1,2,4-TMB**	**1,4-DCB**	**EB**	**$CHCl_3$**	**CB**
Building 1 - First (1st) Floor Indoor Samples													
SRP-06	Building 1, 1st Floor - NW corner office	**1.7**	**0.84**	**0.17**	<0.17	**0.053**	<0.17	**0.76**	**1.6**	**0.71**	**1.4**	**0.36**	**0.42**
SRP-08	Building 1, 1st Floor - E end office	**1.5**	**0.83**	**0.19**	<0.17	**0.053**	<0.17	**0.73**	**1.6**	**1.2**	**1.4**	**0.35**	<0.17
SRP-10	Building 1, 1st Floor - SW corner office	**1.5**	**0.87**	**0.22**	<0.15	**0.053**	<0.15	**0.76**	**1.1**	**0.83**	**1.4**	**0.36**	<0.15
SRP-11	Building 1, 1st Floor - Reception	**1.7**	**0.85**	**0.18**	<0.22	**0.055**	<0.22	**0.89**	**2.0**	**1.7**	**1.5**	**0.36**	**0.29**
Building 1 - Second (2nd) Floor Indoor Samples													
SRP-07	Building 1, 2nd Floor - W end	**1.8**	**0.89**	**0.19**	<0.16	**0.057**	<0.16	**0.70**	**1.7**	**1.2**	**1.6**	**0.39**	**0.26**
SRP-09	Building 1, 2nd Floor - E end	**2.0**	**0.85**	**0.19**	<0.16	**0.052**	<0.16	**0.52**	**1.8**	**1.3**	**1.6**	**0.33**	<0.16
Building 1 - HVAC Sample													
SRP-05	Outdoor/HVAC - Building 1	**1.0**	**0.51**	**0.16**	<0.18	<0.044	<0.18	<0.18	**0.8**	**0.76**	**0.70**	<0.18	<0.18
Building 1 - Outdoor Samples													
SRP-01	Outdoor - Roof of Building 1	**1.1**	**0.54**	**0.14**	<0.17	<0.042	<0.17	<0.17	**0.9**	**1.1**	**0.73**	<0.17	<0.17
SRP-18	Outdoor - SE Roof of Building 1	**0.82**	**0.49**	**0.16**	<0.16	<0.040	<0.16	<0.16	**0.6**	**0.54**	**0.64**	<0.16	<0.16
SRP-20	Outdoor - SE Roof of Building 1 (Duplicate of SRP-18)	**0.78**	**0.48**	**0.17**	<0.18	<0.044	<0.18	<0.18	**0.7**	**0.72**	**0.60**	<0.18	<0.18
SRP-21	Building 1, 1st Floor - NW corner office (blank)	<0.10	<0.025	<0.010	<0.10	<0.025	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Building 4 - Indoor Samples													
SRP-16	Building 4, S end	**1.7**	**1.0**	**0.40**	<0.18	**0.046**	**3.7**	**2.6**	**2.5**	**0.96**	**2.4**	**0.31**	**0.54**
SRP-17	Building 4, middle	**1.6**	**0.99**	**0.30**	<0.21	<0.053	**3.8**	**2.7**	**2.4**	**0.93**	**2.4**	**0.33**	<0.21
SRP-19	Building 4, N end	**1.4**	**0.95**	**0.27**	<0.18	**0.046**	**3.4**	**2.4**	**2.9**	**0.77**	**2.7**	**0.34**	<0.18
SRP-22	Building 4, N end (blank)	<0.10	<0.025	<0.010	<0.10	<0.025	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Building 4 - Outdoor and HVAC Sample													
SRP-04	Outdoor/HVAC - Roof of Building 4	**1.1**	**0.53**	**0.12**	<0.16	<0.040	<0.16	<0.16	**0.8**	**0.38**	**0.70**	<0.16	<0.16
Building 34 - Indoor Samples													
SRP-12	Building 34, S end	**1.2**	**0.54**	**0.15**	<0.18	<0.044	<0.18	**0.33**	**1.1**	**0.69**	**0.80**	<0.18	<0.18
SRP-13	Building 34, N side office	**1.5**	**0.53**	**0.17**	<0.16	**0.17**	**0.34**	<0.16	**2.0**	**1.0**	**1.3**	<0.16	<0.16
SRP-14	Building 34, S end (Duplicate of SRP-12)	**1.7**	**0.84**	**0.22**	<0.16	**0.056**	<0.16	**0.50**	**1.4**	**0.88**	**1.1**	**0.18**	**0.18**
SRP-15	Building 34, middle	**1.2**	**0.58**	**0.15**	<0.15	**0.038**	<0.15	<0.15	**1.0**	**0.64**	**0.83**	<0.15	<0.15
Building 34 - EVAP Sample													
SRP-02	Outdoor - On top of EVAP of Building 34	**1.3**	**0.60**	**0.29**	**0.19**	**0.046**	<0.17	<0.17	**1.0**	**0.85**	**0.93**	<0.17	<0.17
	Outdoor Sample												
SRP-03	Outdoor - Roof of Building 35	**1.2**	**0.56**	**0.17**	<0.15	<0.038	<0.15	<0.15	**1.0**	**0.65**	**0.80**	<0.15	<0.15
Maximum detected concentration on March 2, 2006		**2.0**	**1.0**	**0.40**	**0.19**	**0.17**	**3.8**	**2.7**	**2.9**	**1.7**	**2.7**	**0.39**	**0.54**
Maximum detected concentration on September 27, 2006		**3.7**	**0.51**	**0.2**	**--**	**0.063**	**2**	**0.83**	**3.2**	**1.6**	**3.8**	**0.49**	--
M52-Modified CHHSLs (µg/m^3)		**--**	**600**	**1,800**	**--**	**630,000**	**250,000**	**2,800,000**	**--**	**--**	**-- (2)**	**--**	**--**
ACGIH TLV (µg/m^3)		**1,595**	**169,500**	**268,500**	**264,000**	**40,500**	**19,850**	**1,911,000**	**123,000**	**60,100**	**434,000**	**48,800**	**46,100**
OSHA PEL 8-hour time weighted average (µg/m^3)		**3,190**	**678,000**	**537,000**	**2,600,000**	**202,000**	**None**	**1,900,000**	**None**	**450,000**	**435,000**	**240,000C**	**350,000**
AIHA WEELS		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
EPA Target Indoor Air Concentrations (risk = 10^{-4}; Table 2a)(1)		31	81	2.20	10,000	9.40	200	2,200	6	800	220	11	60
EPA Target Indoor Air Concentrations (risk = 10^{-5}; Table 2b)(1)		3.10	8.10	0.22	10,000	0.94	200	2,200	6	800	22	1.10	60
EPA Target Indoor Air Concentrations (risk = 10^{-6}; Table 2c)(1)		0.31	0.81	0.022	10,000	0.094	200	2,200	6	800	2.2	0.11	60

TABLE 36
INDOOR, OUTDOOR, AND PERIMETER AIR QUALITY SAMPLING RESULTS - DETECTED COMPOUNDS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sample Date: September 27, 2006		Chemical Constituent Detected Concentration (µg/m^3)										
Sample ID	**Location of Sample**	**Benzene**	**PCE***	**TCE***	**1,4-Dioxane***	**1,2-DCA***	**1,1-DCE/VDC***	**1,1,1-TCA***	**1,2,4-TMB**	**1,4-DCB**	**EB**	**$CHCl_3$**
Building 1 - First (1st) Floor Indoor Samples												
SRP-34	Building 1, 1st Floor - NW corner office	**1.4**	**0.51**	**0.16**	<0.14	**0.036**	<0.14	**0.23**	**0.91**	**1.1J**	**1.20**	**0.22**
SRP-35	Building 1, 1st Floor - Reception	**1.1**	**0.32**	**0.13**	<0.15	**0.038**	**0.15**	**0.26**	**0.86**	**1.2J**	**1.2**	**0.2**
SRP-36	Building 1, 1st Floor - E end office	**1.1**	**0.38**	**0.15**	<0.15	<0.038	<0.15	**0.22**	**0.86**	**1.1J**	**1.2**	**0.22**
SRP-40	Building 1, 1st Floor - SW corner office	**1.30**	**0.29**	**0.12**	<0.15	**0.038**	<0.15	**0.23**	**0.80**	**0.77J**	**1.1**	**0.2**
Building 1 - Second (2nd) Floor Indoor Samples												
SRP-27	Building 1, 2nd Floor - E end office (blank)	<0.1	<0.025	<0.01	<0.1	<0.025	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SRP-37	Building 1, 2nd Floor - W end office	**1.1**	**0.31**	**0.14**	<0.14	<0.035	<0.14	<0.14	**0.91**	**0.85J**	**1.3**	**0.17**
SRP-38	Building 1, 2nd Floor - E end office	**1.1**	**0.3**	**0.12**	<0.15	<0.038	<0.15	<0.15	**0.80**	**0.87J**	**1.2**	<0.15
Building 1 - HVAC Sample												
SRP-39	Outdoor/HVAC - At HVAC intake of Building 1	**1.3**	**0.15**	**0.05**	<0.14	<0.035	<0.14	<0.14	**0.48**	**0.66J**	**0.65**	<0.14
Building 4 - Indoor Samples												
SRP-23	Building 4, second storage room from N end	**3.7**	**0.47**	**0.19**	**0.19**	**0.041**	**2**	**0.81**	**3.2**	**1.1J**	**3.8**	**0.39**
SRP-24	Building 4, second storage room from N end (blank)	<0.1	<0.025	<0.01	<0.10	<0.025	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SRP-25	Building 4, middle office	**3.5**	**0.47**	**0.19**	**0.18**	**0.04**	**1.9**	**0.83**	**3.0**	**1.2J**	**3.70**	**0.4**
SRP-26	Building 4, S end office	**3.5**	**0.49**	**0.2**	**0.16**	**0.039**	**2**	**0.81**	**3.0**	**0.9J**	**3.5**	**0.4**
Building 4 - Outdoor and HVAC Sample												
SRP-28	Outdoor/HVAC - At HVAC intake of Building 4	**1.6**	**0.19**	**0.06**	<0.18	<0.044	<0.18	<0.18	**0.58**	**0.8J**	**0.94**	<0.18
Building 34 - Indoor Samples												
SRP-30	Building 34, N side office	**1.9**	**0.23**	**0.08**	<0.16	**0.063**	**0.36**	<0.16	**1.7**	**0.68J**	**2**	**0.48**
SRP-31	Building 34, middle warehouse	**1.7**	**0.44**	**0.06**	<0.16	<0.039	**0.18**	<0.16	**1.5**	**0.92J**	**1.7**	**0.49**
SRP-32	Building 34, S end garage	**2.5**	**0.21**	**0.06**	<0.21	<0.054	**0.23**	<0.21	**1.9**	**0.92J**	**1.9**	**0.47**
SRP-33	Building 34, S end garage (Duplicate of SRP-32)	**2.4**	**0.22**	**0.06**	<0.16	<0.04	**0.22**	<0.16	**1.8**	**1.6J**	**2**	**0.47**
Building 34 - EVAP Sample												
SRP-29	Outdoor - On sidewall of EVAP of Building 34	**1.7**	**0.17**	**0.06**	<0.15	<0.037	<0.15	<0.15	**1.0**	**0.76J**	**1.2**	<0.15
Perimeter Samples												
SRP-41	Perimeter, N of Site	**0.8**	**0.25**	**0.07**	<0.14	<0.036	<0.14	<0.14	**0.36**	**0.66J**	**1.3**	<0.14
SRP-42	Perimeter, SW of Site	**1.40**	**0.13**	**0.06**	<0.19	<0.047	<0.19	<0.19	**0.37**	**0.74J**	**0.59**	<0.19
SRP-43	Perimeter, SE of Site	**0.9**	**0.15**	**0.04**	<0.19	<0.047	<0.19	<0.19	**0.35**	**1.6J**	**0.6**	<0.19
SRP-44	Perimeter, SE of Site (Duplicate of SRP-43)	**1.1**	**0.16**	**0.04**	<0.31	<0.077	<0.31	<0.31	**0.39**	**1.4J**	**0.58**	<0.31
Maximum detected concentration on September 27, 2006		**3.7**	**0.51**	**0.2**	**0.19**	**0.063**	**2**	**0.83**	**3.2**	**1.6J**	**3.8**	**0.49**
Maximum detected concentration on March 2, 2006		**2.0**	**1.0**	**0.40**	**--**	**0.17**	**3.8**	**2.7**	**2.9**	**1.7**	**2.7**	**0.39**
M52-Modified CHHSLs (µg/m^3)		**--**	**600**	**1,800**	**--**	**630,000**	**250,000**	**2,800,000**	**--**	**--**	**-- (2)**	**--**
ACGIH TLV (µg/m^3)		**--**	**169,500**	**268,500**	**72,000**	**40,500**	**19,850**	**1,911,000**	**123,000**	**60,100**	**434,000**	**48,800**
OSHA PEL 8-hour time weighted average (µg/m^3)		**3,190**	**678,000**	**537,000**	**360,000**	**202,000**	**None**	**1,900,000**	**None**	**450,000**	**435,000**	**240,000C**
AIHA WEELS		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
EPA Target Indoor Air Concentrations (risk = 10^{-4}; Table 2a)(1)		31	81	2.20	None	9.40	200	2,200	6	800	220	11
EPA Target Indoor Air Concentrations (risk = 10^{-5}; Table 2b)(1)		3.10	8.10	0.22	None	0.94	200	2,200	6	800	22	1.10
EPA Target Indoor Air Concentrations (risk = 10^{-6}; Table 2c)(1)		0.31	0.81	0.022	None	0.094	200	2,200	6	800	2.2	0.11

TABLE 36
INDOOR, OUTDOOR, AND PERIMETER AIR QUALITY SAMPLING RESULTS - DETECTED COMPOUNDS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Notes:

Bold values indicate detects.

* Site Contaminants of Concern (COCs).

< = Less than, analyte not detected at concentration greater than the reporting limit shown.

-- = not applicable

EPA = United States Environmental Protection Agency

µg/m^3 = micrograms per cubic meter

M52-Modified CHHSLs = California Human Health Screening Levels recommended by EPA for Operable Unit 3. See Table 1 attached to the October 9, 2007 letter: EPA Region 9's Recommended Screening Approach to Evaluate Vapor Intrusion at the Motorola 52nd Street Superfund Street, Operable Unit 3 (EPA, 2007i).

ACGIH TLV = American Conference of Governmental Industrial Hygienists, Threshold Limit Value

AIHA WEELS = American Industrial Hygiene Association Workplace Environmental Exposure Levels

OSHA PELS = Occupational Safety & Health Administration, Permissible Exposure Limit

(1) = EPA Subsurface Vapor Intrusion Guidance, November 2002

(2) = Calculation of a screening number for the chemical has been postponed until the toxicity criterion currently being developed by the Office of Environmental Health and Hazard Assessment (OEHHA) is published as a final document.

J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

C = Ceiling Limit

CB = Chlorobenzene

$CHCl_3$ = Chloroform

1,2-DCA = 1,2-Dichloroethane

1,4-DCB = 1,4-Dichlorobenzene

EB = Ethylbenzene

PCE = Tetrachloroethene

TCE = Trichloroethene

1,1,1-TCA = 1,1,1-Trichloroethane

1,1-DCE = 1,1-Dichloroethene

1,2,4-TMB = 1,2,4-Trimethylbenzene

VDC = Vinylidene Chloride

NW = Northwest direction

SW = Southwest direction

SE = Southeast direction

W = West direction

E = East direction

S = South direction

N = North direction

EVAP = Evaporative Cooling System

HVAC = Heating, Ventilation, and Air Conditioning

NA = not available

ID = identification

TABLE 37
SUMMARY OF INDOOR AIR DATA COMPARED TO SCREENING LEVELS
Salt River Project's 16th Street Facility
Phoenix, Arizona

Sampling Date	Chemical	Maximum Indoor Air Concentration (µg/m^3)	Screening Level[(1)] (µg/m^3)	Ratio-Carcinogens[(3)]	Carcinogenic Risk[(4)]	Hazard Index[(3)]
March 2, 2006	1,1,1-Trichloroethane*	2.7	2200	--	--	1.2E-03
	1,1-Dichloroethene/ Vinylidene Chloride*	3.8	200	--	--	1.9E-02
	1,2,4-Trimethylbenzene	2.9	6	--	--	4.8E-01
	1,2-Dichloroethane*	0.17	0.094	1.8E+00	1.8E-06	--
	1,4-Dichlorobenzene	1.7	800	--	--	2.1E-03
	Benzene	2.0	0.31	6.5E+00	6.5E-06	--
	Chlorobenzene	0.54	60	--	--	9.0E-03
	Chloroethane/ Ethyl Chloride*	0.19	10,000	--	--	1.9E-05
	Chloroform	0.39	0.11	3.5E+00	3.5E-06	--
	Ethylbenzene[(2)]	2.7	2.2	1.2E+00	1.2E-06	--
	Tetrachloroethene*	1.0	0.81	1.2E+00	1.2E-06	--
	Trichloroethene*	0.40	1.22	3.3E-01	3.3E-07	--
	Total				**1.5E-05**	**0.51**
September 27, 2006	1,1,1-Trichloroethane*	0.83	2200	--	--	3.8E-04
	1,1-Dichloroethene/ Vinylidene Chloride*	2.0	200	--	--	1.0E-02
	1,2,4-Trimethylbenzene	3.2	6	--	--	5.3E-01
	1,2-Dichloroethane*	0.063	0.094	6.7E-01	6.7E-07	--
	1,4-Dichlorobenzene	1.6	800	--	--	2.0E-03
	1,4-Dioxane*	0.19	NA	--	--	--
	Benzene	3.7	0.31	1.2E+01	1.2E-05	--
	Chloroform	0.49	0.11	4.5E+00	4.5E-06	--
	Ethylbenzene[(2)]	3.8	2.2	1.7E+00	1.7E-06	--
	Tetrachloroethene*	0.5	0.81	6.2E-01	6.2E-07	--
	Trichloroethene*	0.20	1.22	1.6E-01	1.6E-07	--
	Total				**2.0E-05**	**0.55**

Notes:

(1) = EPA Subsurface Vapor Intrusion Guidance, Table 2c, November 2002, (EPA, 2002) except for trichloroethene. Per EPA, California EPA screening criteria (OEHHA, 2005) for trichloroethene was used.

(2) = The screening level for ethylbenzene is based on carcinogenicity although EPA has withdrawn the toxicity criteria since the guidance was published in 2002 (EPA, 2002).

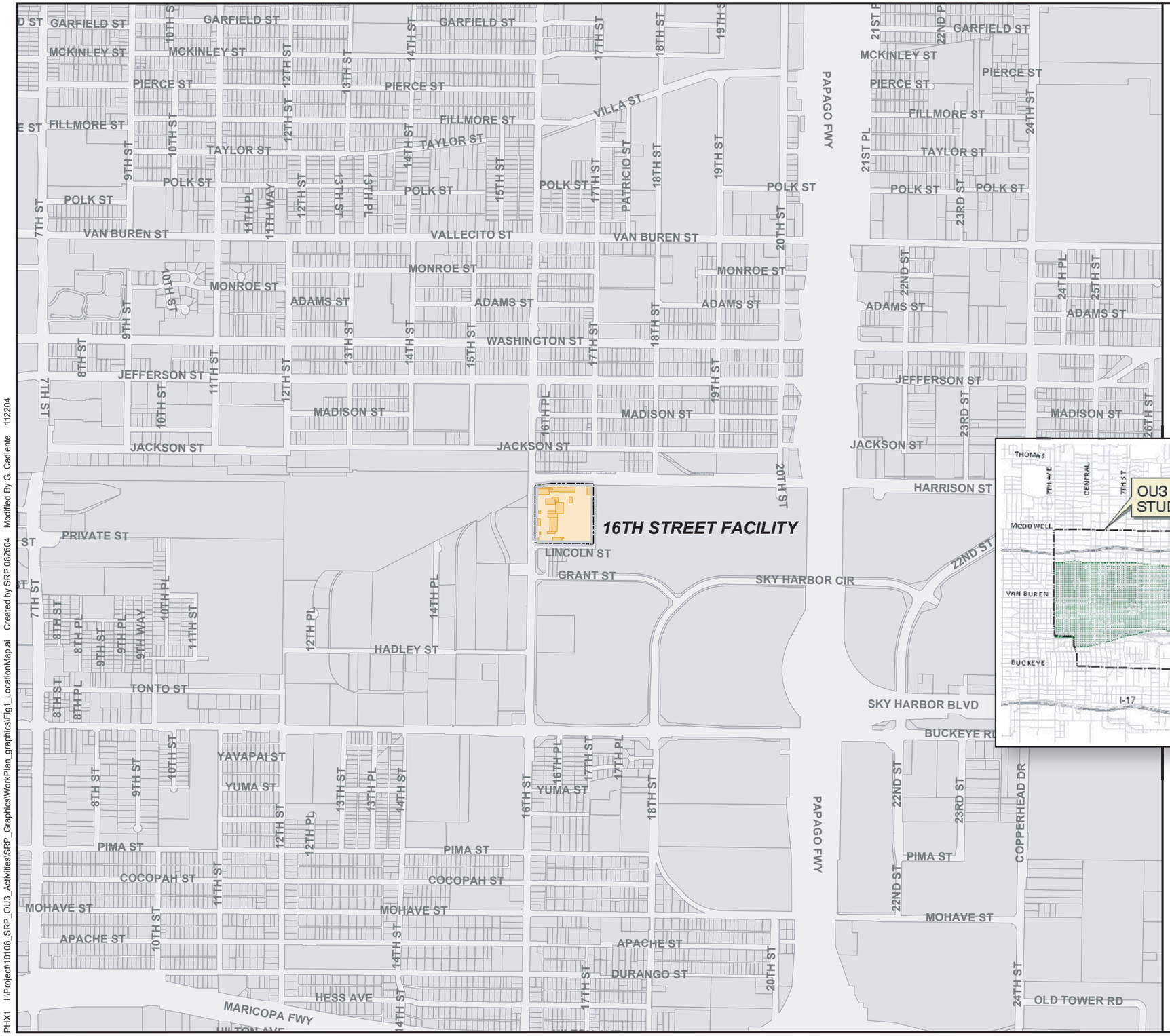
(3) = Ratio of maximum indoor air concentration to screening level.

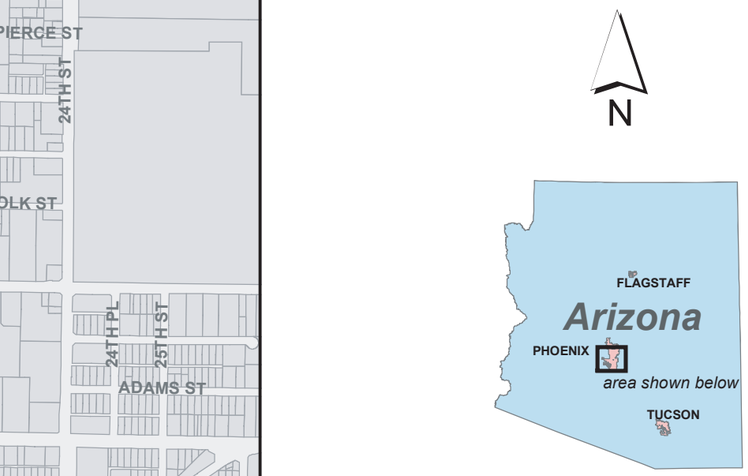
(4) = For carcinogens, the ratio for all chemicals is multiplied by $1x10^{-6}$ to estimate potential carcinogenic risk. For noncarcinogens the sum of the ratios is not adjusted.

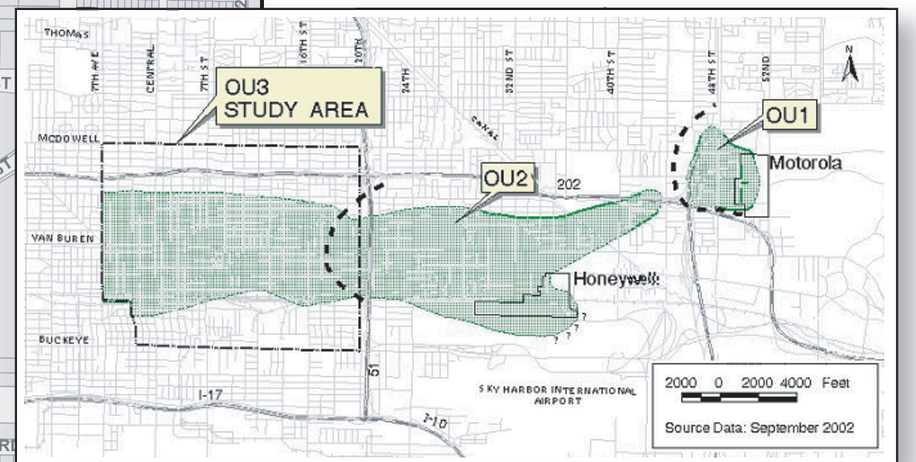
EPA, 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), Office of Solid Waste and Emergency Response, November 29.

-- = not applicable
µg/m^3 = micrograms per cubic meter
* Site Contaminants of Concern (COCs)
EPA = United States Environmental Protection Agency
OEHHA = Office of Environmental Health and Hazard Assessment
NA = not available

FIGURES





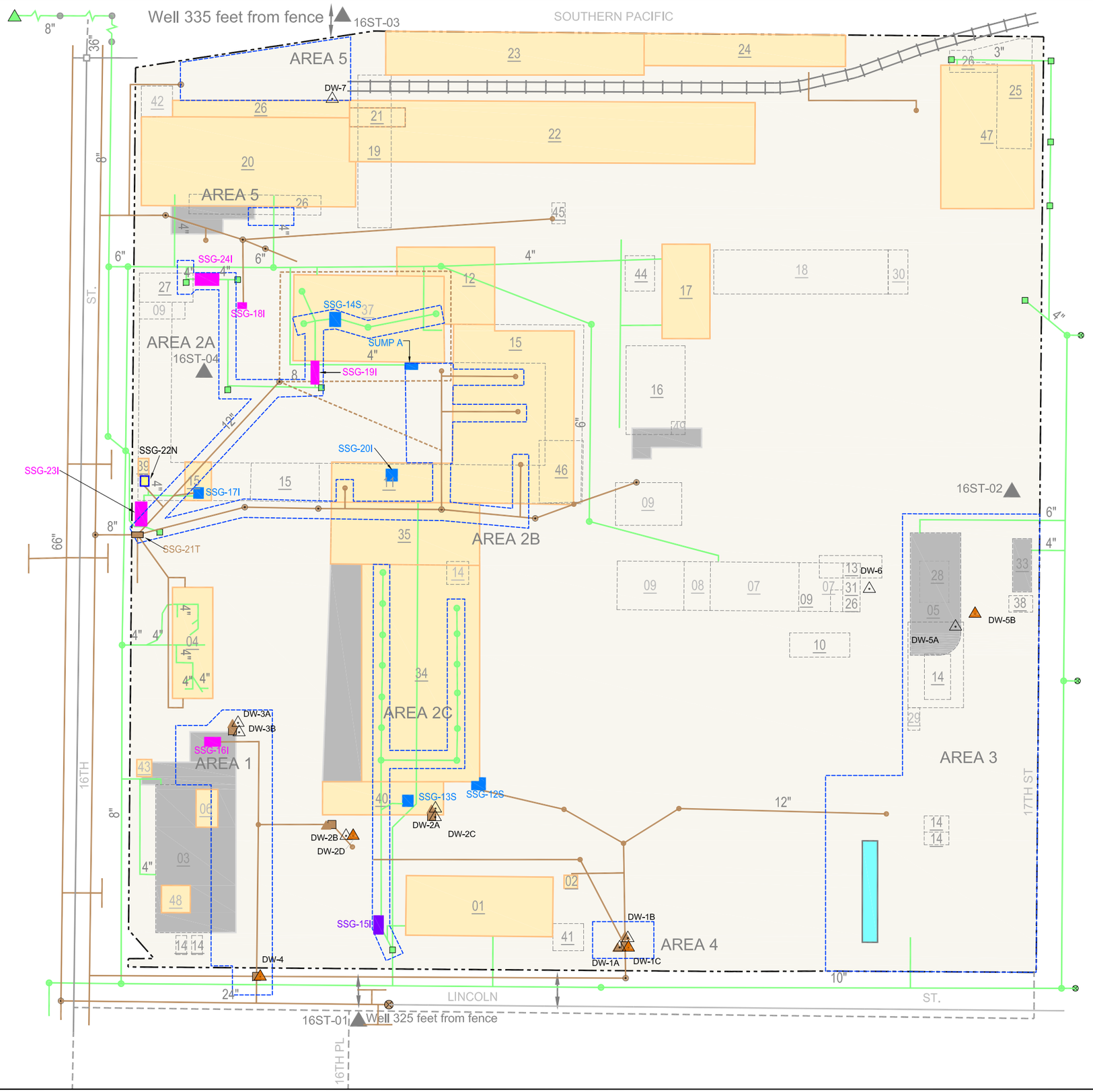


0 460 920 1,840 2,760 3,680
FEET

SITE LOCATION MAP
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: - gc	Date: 02/10/06	Project No. 10108
amec		Figure 1

PHX1 I:\Project\10108_SRP_OU3_Activities\SRP_GraphicsWorkPlan_graphics\Fig1_LocationMap.ai Created by SRP 082604 Modified By G. Cadiente 112204



Explanations

- Dry Well Reported
- Dry Well Confirmed
- Monitor Well
- Storm Drain Cleanout
- Storm Drain Plug
- Storm Drain Gravel Well (Dry Well)
- Storm Drain Catch Well (Dry Well)
- Storm Drain Inlet
- Storm Drain Manhole
- Storm Drain Sand Trap
- Storm Drain - Open
- Storm Drain - Pipe
- Sewer Drain
- Sewer Plug
- Sewer Cleanout
- Sewer Flush Tank
- Sewer Manhole
- Sewer
- Sewer Interceptor Grease Trap
- Sump
- Neutralizer
- Slab
- Historical Building Locations
- Present Building Locations
- Scale
- Sump SSG-15I Removed
- Not to Scale

01 OFFICE BUILDING
02 GUARD HOUSE
03 ELECTRIC SHOP THROUGH 1974; PAINT/BODY SHOP
04 IRRIGATION BUILDING OFFICES (HYDROGRAPHIC WORKSHOP-1954 THROUGH MID 1970'S)
05 SALVAGE BUILDING / SALVAGE SHED
06 ICE HOUSE
07 METER REPAIR SHOP (1936); METER SHOP ADDITION (1954)
08 RADIO REPAIR SHOP
09 FIRE PROOF VAULTS
10 OFFICE
11 PAINT AND BODY SHOP THROUGH CIRCA 1975; STORAGE; REPAIR GARAGE THROUGH CIRCA 1986; CARPENTER SHOP THROUGH 1992; WAREHOUSE
12 AUTO PARTS STORAGE
13 SHED
14 OUT BUILDINGS
15 PARKING SHED
16 LINE MATERIAL WAREHOUSE
17 CENTRAL LINE BUILDING (OFFICES)
18 METER & ELECTRIC SHOP THROUGH 1935; ELECTRIC SHOP THROUGH 1950; LUMBER STORAGE
19 TROLLEY
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27 OFFICE
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29 INCINERATOR
31 TOOL SHED THROUGH 1952; HYDROGRAPHIC WORKSHOP
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35 AUTO PARTS CONFERENCE ROOM THROUGH 19??; LAB AND OFFICE
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43 OIL FILTER HOUSE
44 TRANSFORMER OIL TEST HOUSE
45 DOMESTIC WELL/PUMP HOUSE
46 SHED
47 WAREHOUSE
48 ACROLEIN STORAGE
49 PORTABLE OFFICE

N

0 70 140 280 FEET

SITE PLAN

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: LD	Date: 01/26/2008	Project No. 10108.000
amec		Figure 2

Plot Date: 01/21/09 - 4:02pm, Plotted by: LineDesign
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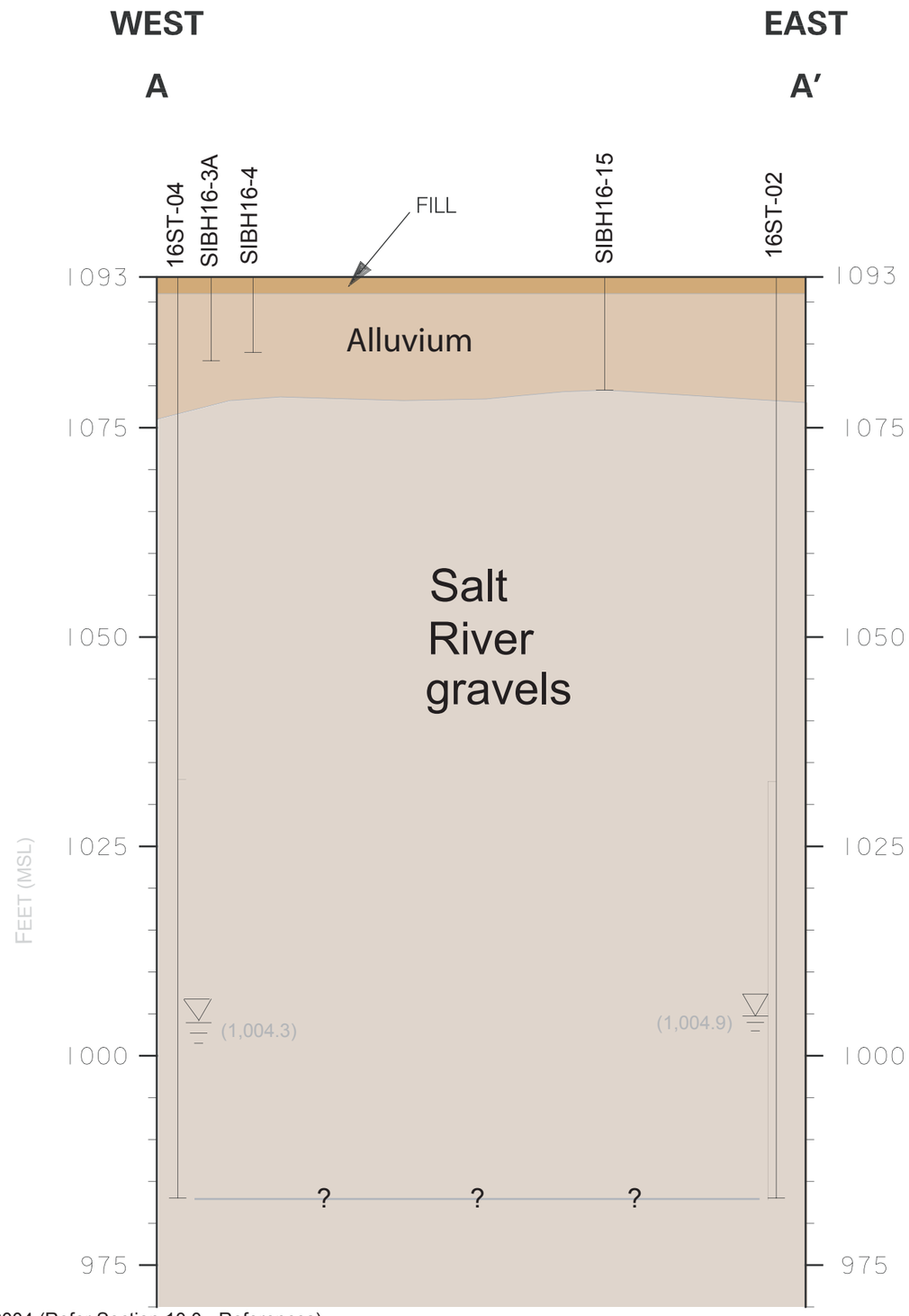
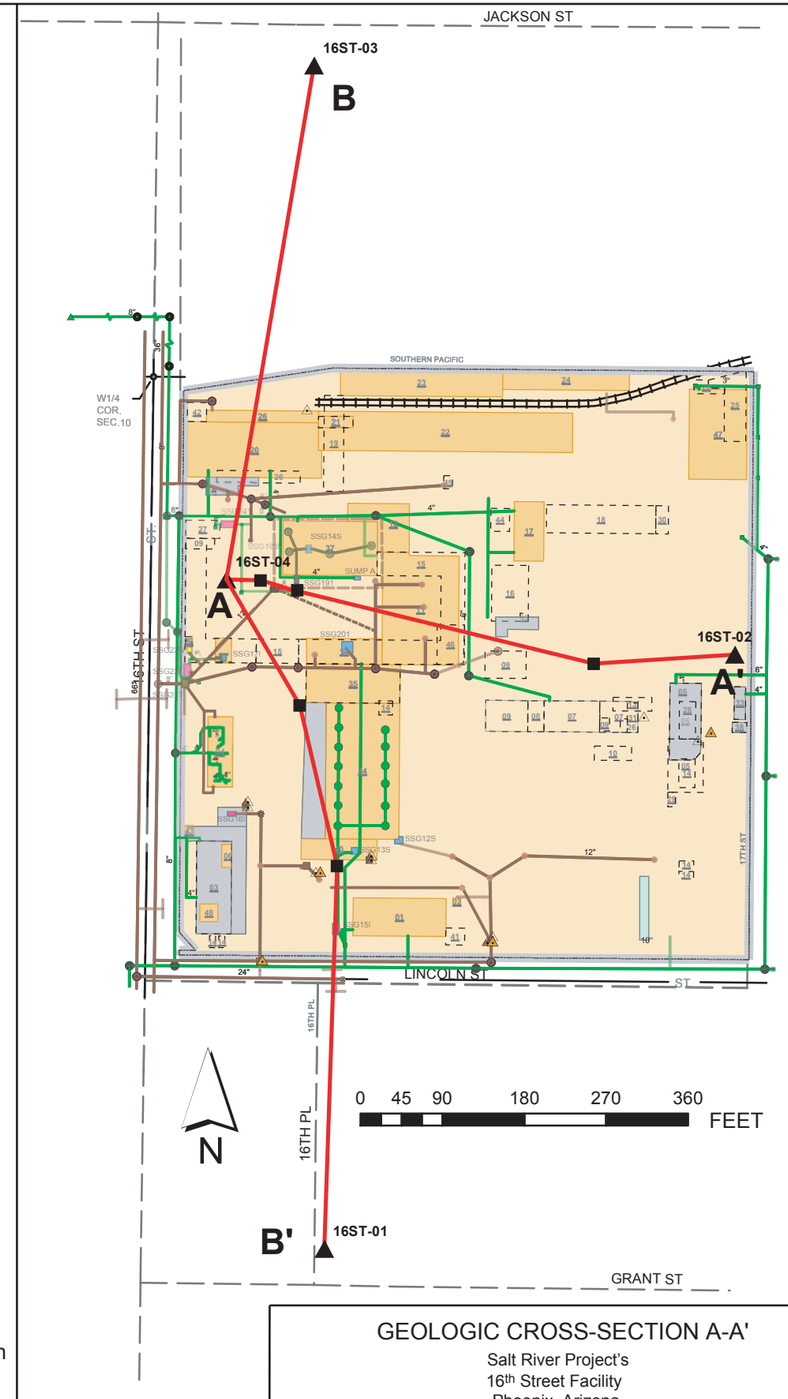


Explanations

MSL		Mean Sea Level
▽		Depth To Water (March, 2007)
TD		Total Depth
16ST-02	▲	Monitor Well Location
SIBH16-15	■	Soil Boring Location
(1,004.9)		Water Level Elevation, Feet, MSL

Note: All locations are approximate



Source: SRP, 2004 (Refer Section 10.0 - References)

GEOLOGIC CROSS-SECTION A-A'

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: np	Date: 02/19/2008	Project No. 10108
amec		Figure 3

PHX1 I:\Project\10108_SRP_OU3_Activities\SRP_Graphics\Fig5_CrossSection-A.ai Created By SRP 082604 Modified By G. Cadiente 112204

NORTH **SOUTH**

B **B′**

16ST–03 16ST–04 SIBH16–5B SIBH16–8 SIBH16–9 FILL 16ST–01

1093 1075 1050 1025 1000 975 FEET (MSL)

Alluvium

Salt River gravels

(1,004.4) (1,004.3) (1,005.0)

? ? ? ? ? ?

25 FEET

200 FEET

Explanations

MSL	Mean Sea Level
▽	Depth to Water (March, 2007)
TD	Total Depth
(1,005.0)	Water Level Elevation, Feet, MSL
16ST-02	Monitor Well Location
S1BH16-9	Soil Boring Location

Notes:
Cross-section location shown on Figure 3.

All locations are approximate.

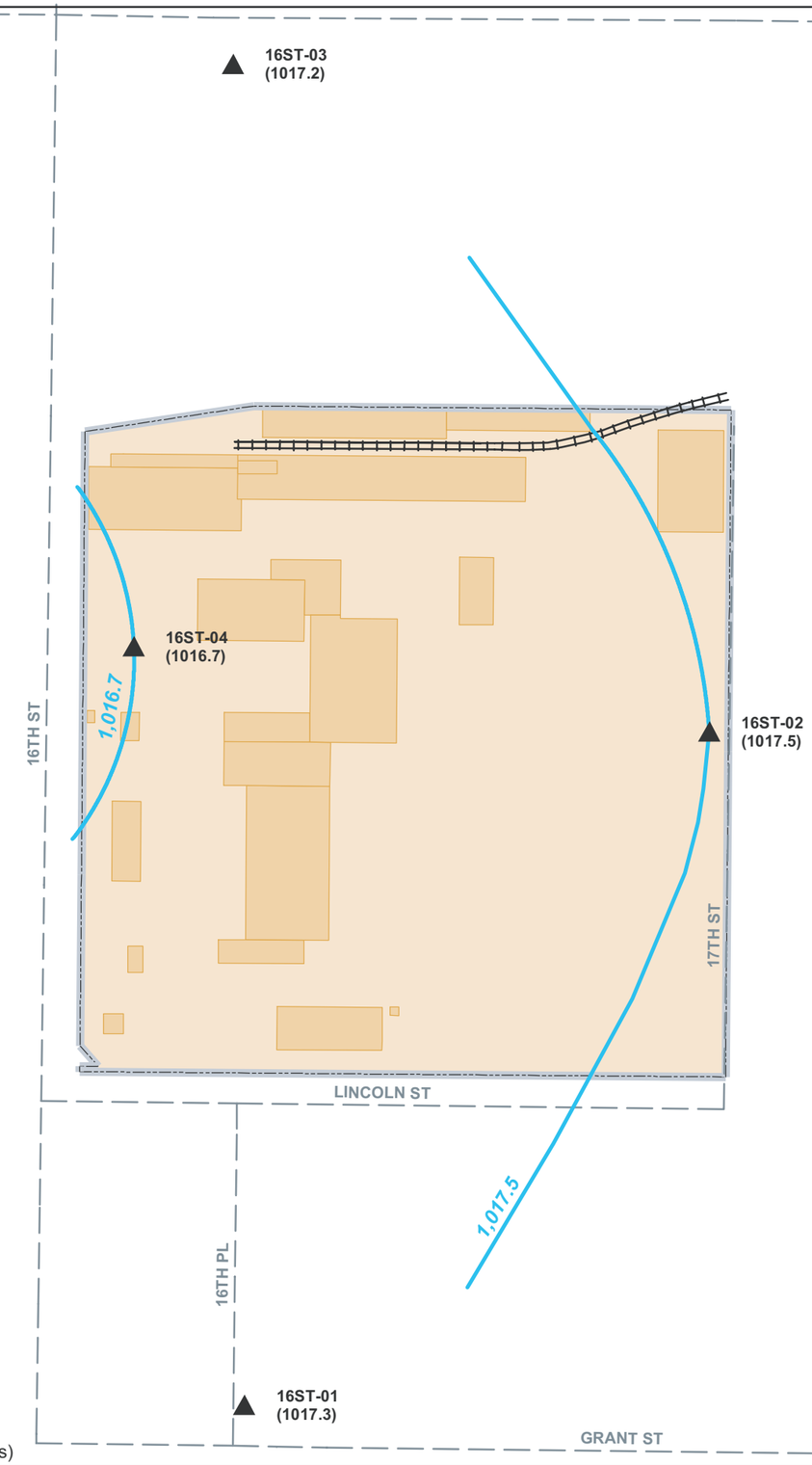
Source: SRP, 2004 (Refer Section 10.0 - References)

GEOLOGIC CROSS-SECTION B-B'

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: np	Date: 02/19/2008	Project No. 10108
amec		Figure 4

PHX1 I:\Project\10108_SRP_OU3_Activities\SRP_Graphics\Fig6_CrossSection-B.ai Created By SRP 082604 Modified By G. Cadiente 112204



Source: SRP, 2004 (Refer Section 10.0 - References)

Explanations

MSL	Mean Sea Level
16ST-02 ▲	Monitor Well Location
1,016.7	Water Level Elevation Contour, Feet, MSL
(1,016.7)	Water Level Elevation, Feet, MSL

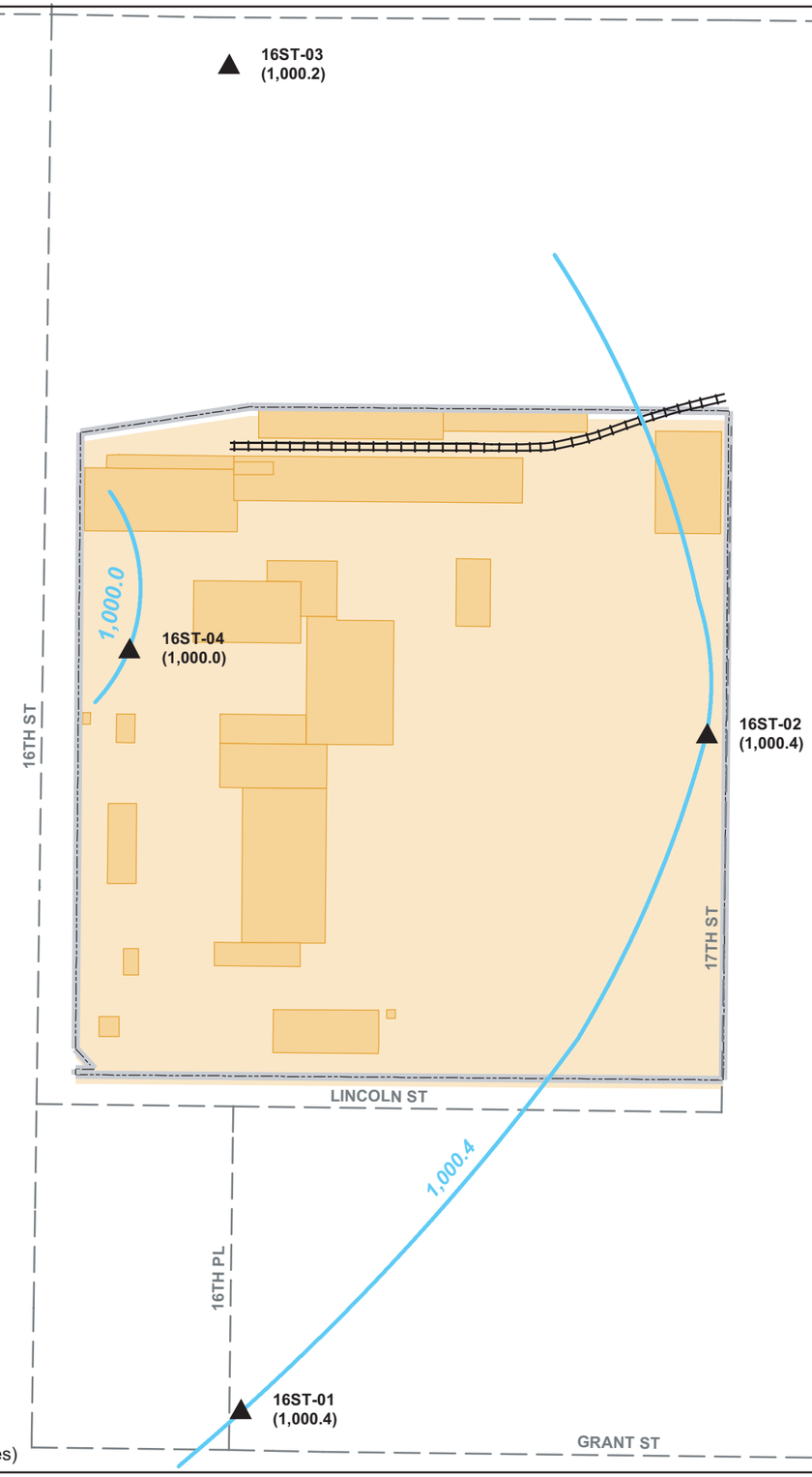
N

0 45 90 180 270 360 FEET

GROUNDWATER ELEVATION MAP
JUNE 2001
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: np	Date: 02/19/08	Project No. 10108
amec		Figure 5

PHX1 I:\Project\10108_SRP_OU3_Activities\SRP_Graphics\WorkPlan_graphics\Fig7_GWElevation-0601.ai Created By SRP 082604 Modified By G. Cadiente 112204



Source: SRP, 2004 (Refer Section 10.0 - References)

Explanations

MSL		Mean Sea Level
16ST-02	▲	Monitor Well Location and Identification
1,000.0	/	Water Elevation Contour, Feet, MSL, Queried Where Uncertain
(1,000.0)		Water Level Elevation, Feet, MSL

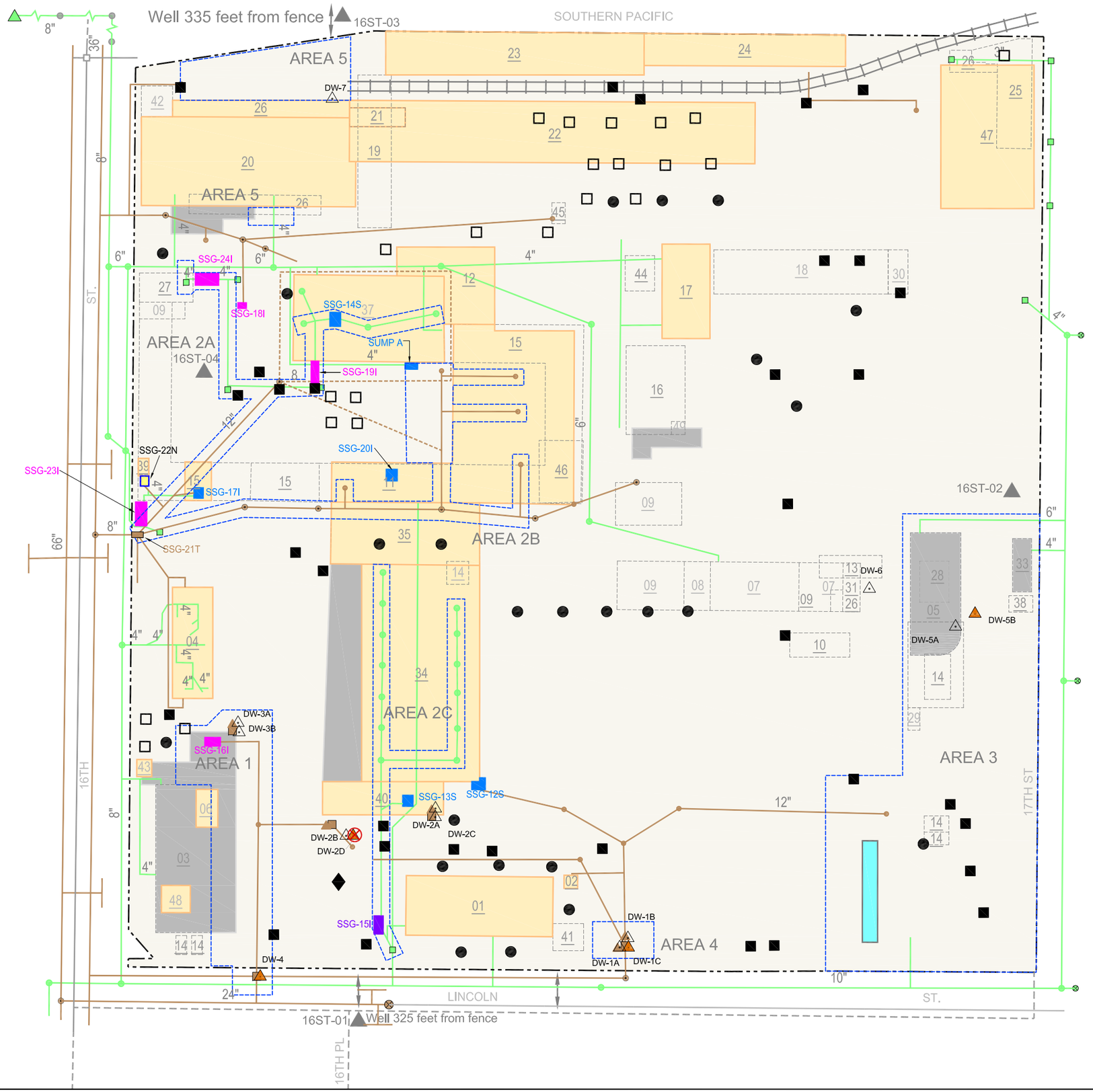
N

0 45 90 180 270 360 FEET

GROUNDWATER ELEVATION MAP
JUNE 2004
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: np	Date: 02/19/08	Project No. 10108
amec		Figure 6

PHX1 I:\Project\10108_SRP_OU3_Activities\SRP_Graphics\WorkPlan_graphics\Fig8_GWElevation-0604.ai Created By SRP 082604 Modified By G. Cadiente 112204



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- Sewer Flush Tank
- Sewer Manhole
- Sewer
- Sewer Interceptor Grease Trap
- Sump
- Neutralizer
- Slab
- Historical Building Locations
- Potential Source Area
- Present Building Locations
- Scale
- Sump SSG-15I Removed
- Not to Scale
- UST Soil Sampling, 1987-1990 (no COC data)
- Soil Boring Investigation, 1989
- Soil Sample Location (Drywell Investigation, 1990)
- Soil Sample Location (Fireline Trench Investigation, 1990)
- Monitor Well (Groundwater Investigation, 2001)
- Soil Gas Survey, 2002
- UST Underground Storage Tank
- COC Contaminants of Concern

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49 PORTABLE OFFICE

N

0 70 140 280 FEET

PREVIOUS SITE INVESTIGATIONS

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: LD	Date: 01/04/2008	Project No. 10108.000
amec		Figure 7

Plot Date: 01/21/09 - 4:03pm, Plotted by: LineDesign
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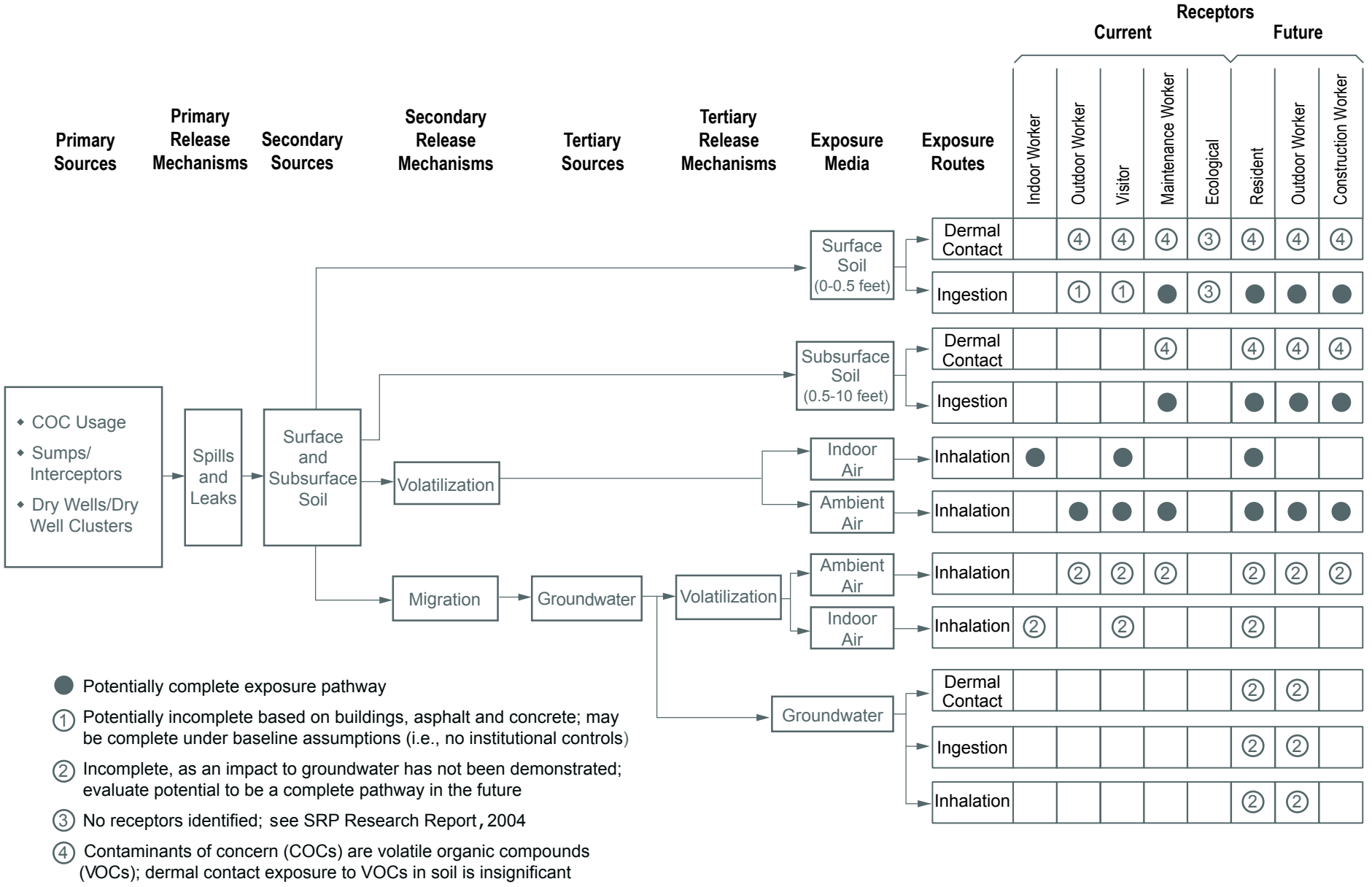

CONCEPTUAL SITE MODEL
Salt River Project's
16th Street Facility
Phoenix, Arizona

Project No.
10108

Figure
8

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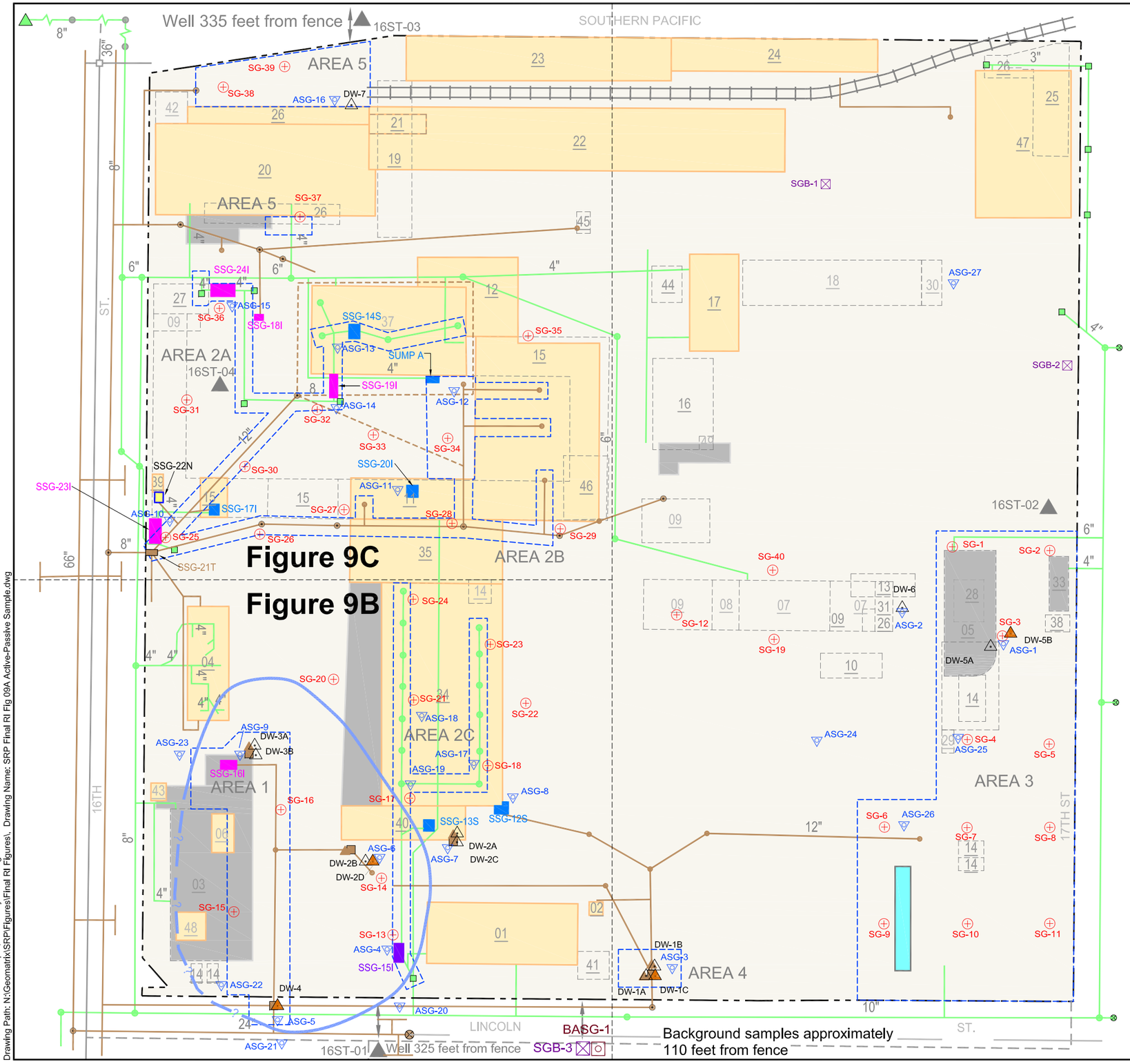

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- Sewer Cleanout
- Sewer Flush Tank
- Sewer Manhole
- Sewer
- Sewer Interceptor Grease Trap
- Sump
- Neutralizer
- Slab
- Historical Building Locations
- Scale
- Potential Source Area
- AREA 3 -Designated PSA
- SG-1 Passive Soil Gas Location
- SGB-2 Background Passive Soil Gas Location
- ASG-1 Active Soil Gas Location
- BASG-1 Background Active Soil Gas Location
- Sump SSG-15I Removed
- Present Building
- Not to Scale
- ? 1µg/L based on deep soil gas analytical results (Dashed where inferred)
- µg/L Microgram per Liter

01 OFFICE BUILDING
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03 ELECTRIC SHOP THROUGH 1974; PAINT/BODY SHOP
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49 PORTABLE OFFICE

0 70 140 280 FEET

N

ACTIVE AND PASSIVE SOIL GAS SAMPLING LOCATIONS
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: ld	Date: 01/21/09	Project No. 10108
amec		Figure 9A

Plot Date: 01/21/09 - 4:00pm, Plotted by: LineDesign
Drawing Path: N:\Geomatrix\SRP\Figures\Final RI Figures\, Drawing Name: SRP Final RI Fig 09A Active-Passive Sample.dwg

Refer to Figure 9C

Refer to Figure 9A

SG-24
SG-23
SG-20
SG-21
SG-22
ASG-18
AREA 2C
ASG-9
ASG-23
DW-3A
DW-3B
SSG-16I
AREA 1
ASG-17
SG-18
ASG-19
SG-17
ASG-8
SG-16
SSG-12S
SSG-13S
DW-2A
DW-2C
ASG-6
ASG-7
DW-2B
DW-2D
SG-14
SG-15
SG-13
ASG-4
SSG-15I
ASG-22
DW-4
ASG-20
ASG-5
ASG-21
SGB-3
BASG-1
16ST-01 Well 325 feet from fence
16TH PL
16TH
LINCOLN
04
14
34
43
06
03
48
02
01
41
40
4"
8"
24"

Explanations

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AREA 3 -Designated PSA

- SG-1 Passive Soil Gas Location
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- ASG-1 Active Soil Gas Location
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µg/L Microgram per Liter

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43 OIL FILTER HOUSE
48 ACROLEIN STORAGE

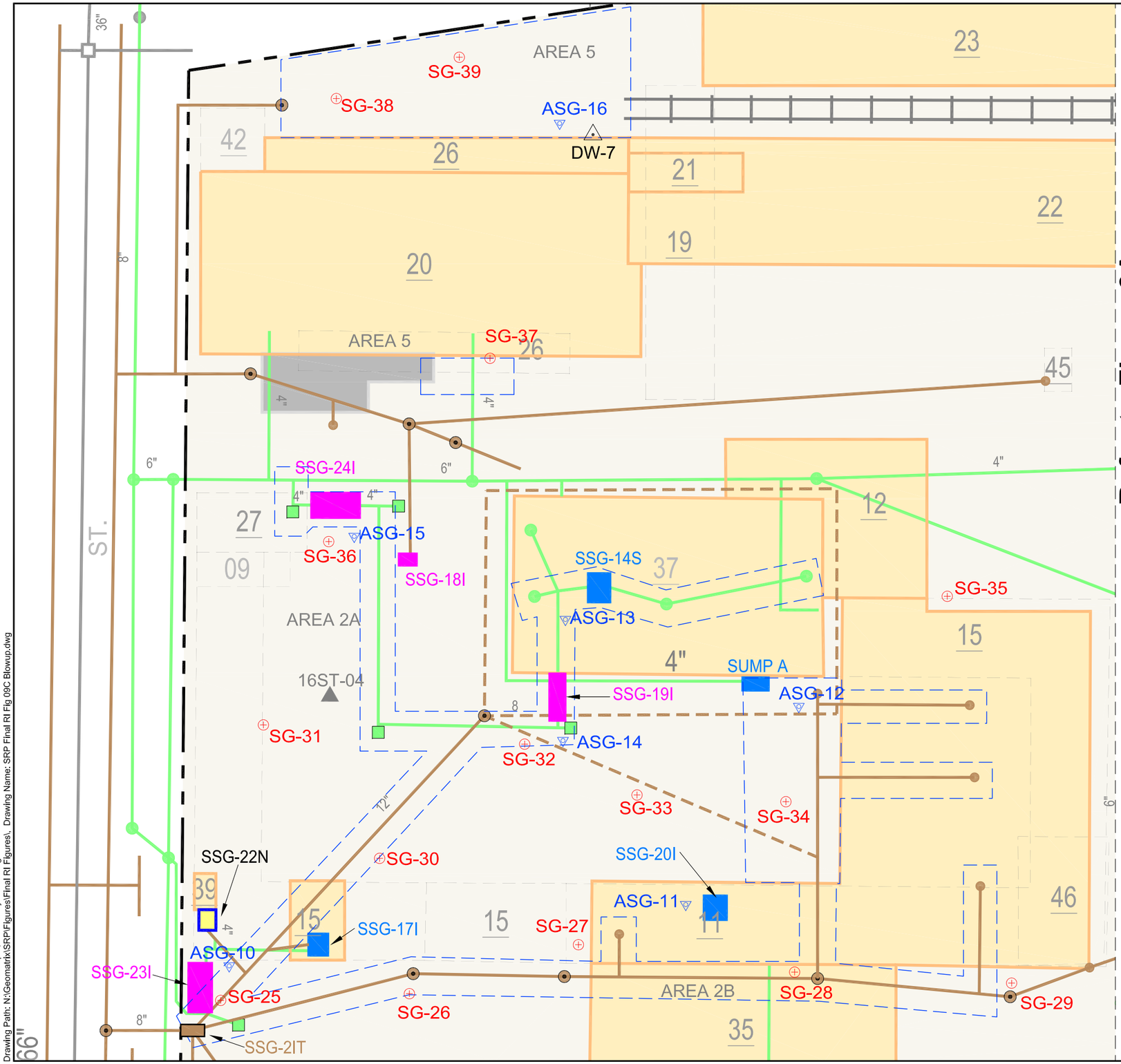
N

0 35 70 FEET

ACTIVE AND PASSIVE SOIL GAS SAMPLING LOCATIONS - PSA 1 AND PSA 2C
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: ld	Date: 01/21/09	Project No. 10108
amec		Figure 9B

Plot Date: 01/21/09 - 2:05pm, Plotted by: LineDesign
Drawing Path: N:\Geomatrix\SRP\Figures\Final RI Figures\, Drawing Name: SRP Final RI Fig 09B Blowup.dwg



Refer to Figure 9A

Explanations

- Dry Well Reported
- Dry Well Confirmed
- Monitor Well
- Storm Drain Cleanout
- Storm Drain Plug
- Storm Drain Gravel Well (Dry Well)
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09 FIRE PROOF VAULTS
11 PAINT AND BODY SHOP THROUGH CIRCA 1975; STORAGE; REPAIR GARAGE THROUGH CIRCA 1986 CARPENTER SHOP THROUGH 1992; WAREHOUSE
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27 OFFICE
35 AUTO PARTS CONFERENCE ROOM THROUGH 19??; LAB AND OFFICE
37 TRANSPORTATION GARAGE & MACHINE SHOP
39 BATTERY BUILDING
42 BLOCK BUILDING
43 OIL FILTER HOUSE
45 DOMESTIC WELL/PUMP HOUSE
46 SHED

N

0 35 70 FEET

ACTIVE AND PASSIVE SOIL GAS SAMPLING LOCATIONS - PSA 2A, 2B AND PSA 5
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: ld	Date: 01/21/09	Project No. 10108
amec		Figure 9C

Plot Date: 01/21/09 - 3:59pm Plotted by: LineDesign
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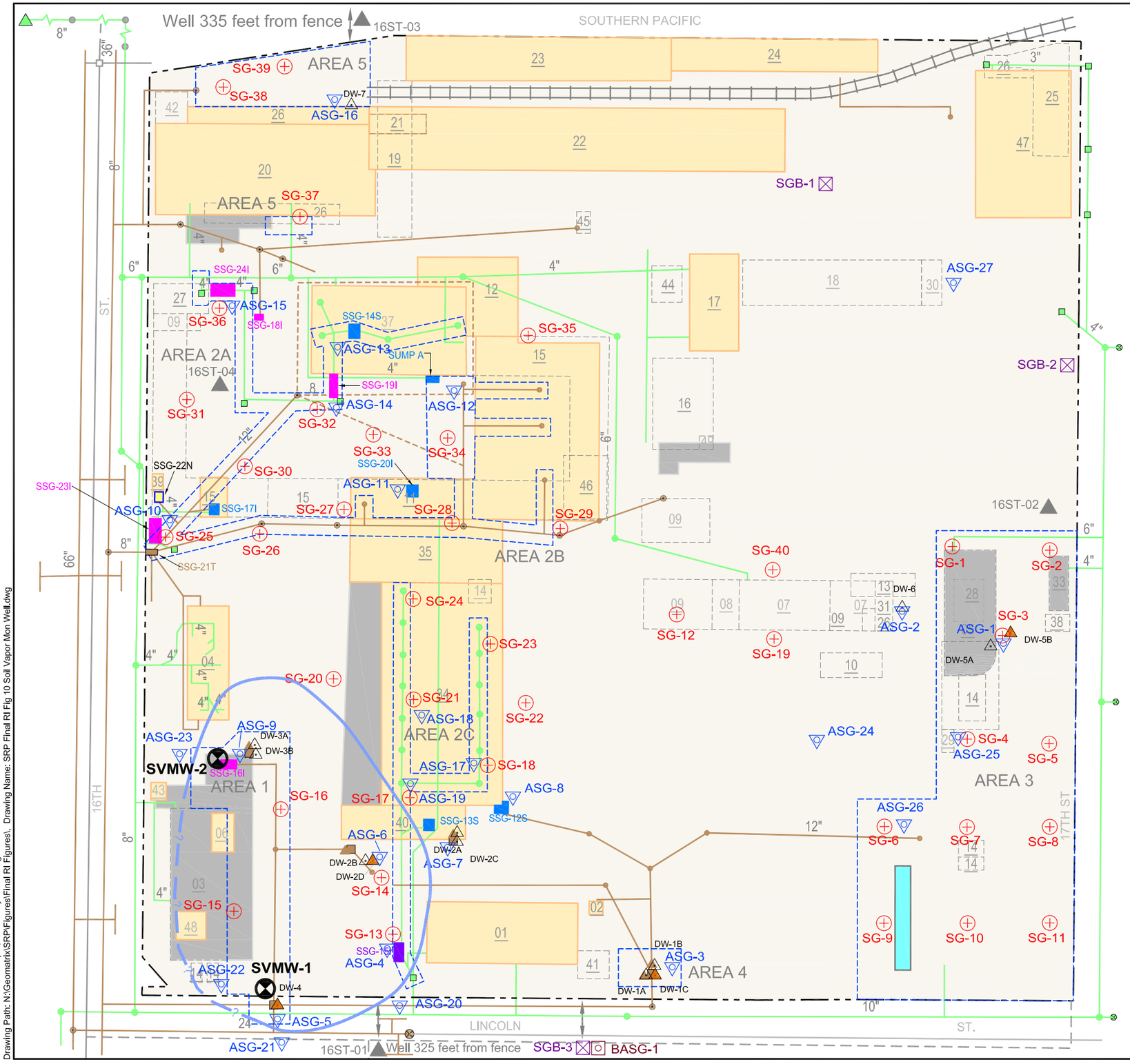

Explanations

- Dry Well Reported
- Dry Well Confirmed
- Monitor Well
- Storm Drain Cleanout
- Storm Drain Plug
- Storm Drain Gravel Well (Dry Well)
- Storm Drain Catch Well (Dry Well)
- Storm Drain Inlet
- Storm Drain Manhole
- Storm Drain Sand Trap
- Storm Drain - Open
- Storm Drain - Pipe
- Sewer Drain
- Sewer Plug
- Sewer Cleanout
- Sewer Flush Tank
- Sewer Manhole
- Sewer
- Sewer Interceptor Grease Trap
- Sump
- Neutralizer
- Slab
- Historical Building Locations
- Potential Source Area
- AREA 3 -Designated PSA
- SG-1 Passive Soil Gas Location
- SGB-2 Background Passive Soil Gas Location
- ASG-1 Active Soil Gas Location
- BASG-1 Background Active Soil Gas Location
- Soil Vapor Monitor Well Location
- SVMW-

- Sump SSG-15I Removed
- Present Building
- Scale
- Not to Scale
- ? 1µg/L based on deep soil gas analytical results (Dashed where inferred)

µg/L Microgram per Liter

01 OFFICE BUILDING
02 GUARD HOUSE
03 ELECTRIC SHOP THROUGH 1974; PAINT/BODY SHOP
04 IRRIGATION BUILDING OFFICES (HYDROGRAPHIC WORKSHOP-1954 THROUGH MID 1970'S)
05 SALVAGE BUILDING / SALVAGE SHED
06 ICE HOUSE
07 METER REPAIR SHOP (1936); METER SHOP ADDITION (1954)
08 RADIO REPAIR SHOP
09 FIRE PROOF VAULTS
10 OFFICE
11 PAINT AND BODY SHOP THROUGH CIRCA 1975; STORAGE; REPAIR GARAGE THROUGH CIRCA 1986 CARPENTER SHOP THROUGH 1992; WAREHOUSE
12 AUTO PARTS STORAGE
13 SHED
14 OUT BUILDINGS
15 PARKING SHED
16 LINE MATERIAL WAREHOUSE
17 CENTRAL LINE BUILDING (OFFICES)
18 METER & ELECTRIC SHOP THROUGH 1935; ELECTRIC SHOP THROUGH 1950; LUMBER STORAGE
19 TROLLEY
20 WAREHOUSE
21 DOCK OFFICE
22 SOUTH WAREHOUSE DOCK
23 PLANER SHED (TEMP WAREHOUSE)
24 WAREHOUSE
25 CEMENT WAREHOUSE
26 WOOD PLATFORM
27 OFFICE
28 YARD SHOP
29 INCINERATOR
30 PLATFORM
31 TOOL SHED THROUGH 1952; HYDROGRAPHIC WORKSHOP
33 SALVAGE OFFICE
34 HEAVY EQUIPMENT GARAGE THROUGH 1986; WAREHOUSE
35 AUTO PARTS CONFERENCE ROOM THROUGH 19??; LAB AND OFFICE
36 WASH STALL
37 TRANSPORTATION GARAGE & MACHINE SHOP
38 RECLAMATION OFFICE
39 BATTERY BUILDING
40 UNLOADING AND CLEANING PLATFORM
41 SPRAY OIL SHOP
42 BLOCK BUILDING
43 OIL FILTER HOUSE
44 TRANSFORMER OIL TEST HOUSE
45 DOMESTIC WELL/PUMP HOUSE
46 SHED
47 WAREHOUSE
48 ACROLEIN STORAGE
49 PORTABLE OFFICE

N

0 35 70 FEET

SOIL VAPOR MONITOR WELL LOCATIONS

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: ld	Date: 01/21/09	Project No. 10108
amec		Figure 10

Plot Date: 01/21/09 - 4:04pm Plotted by: LineDesign
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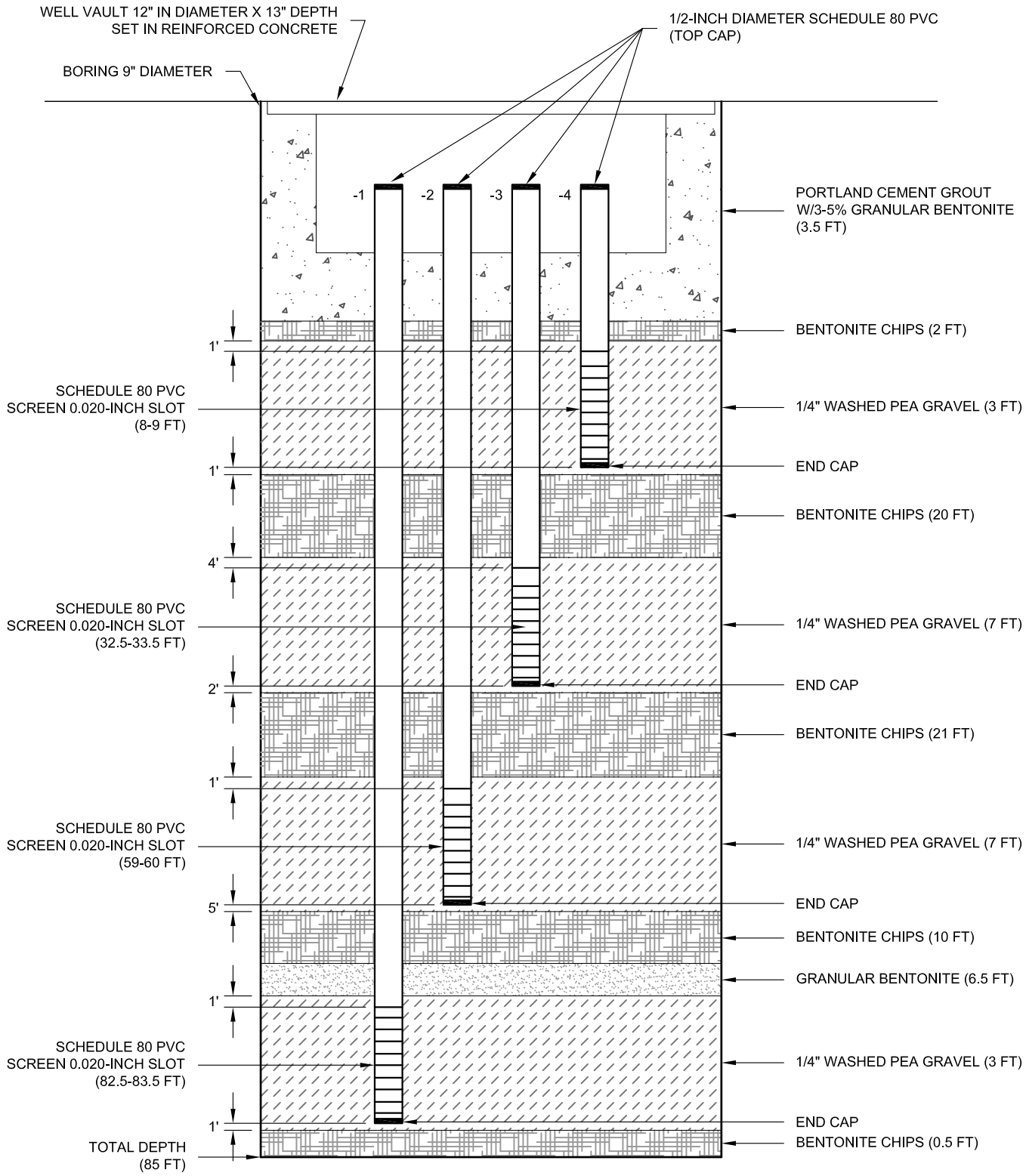


Notes:

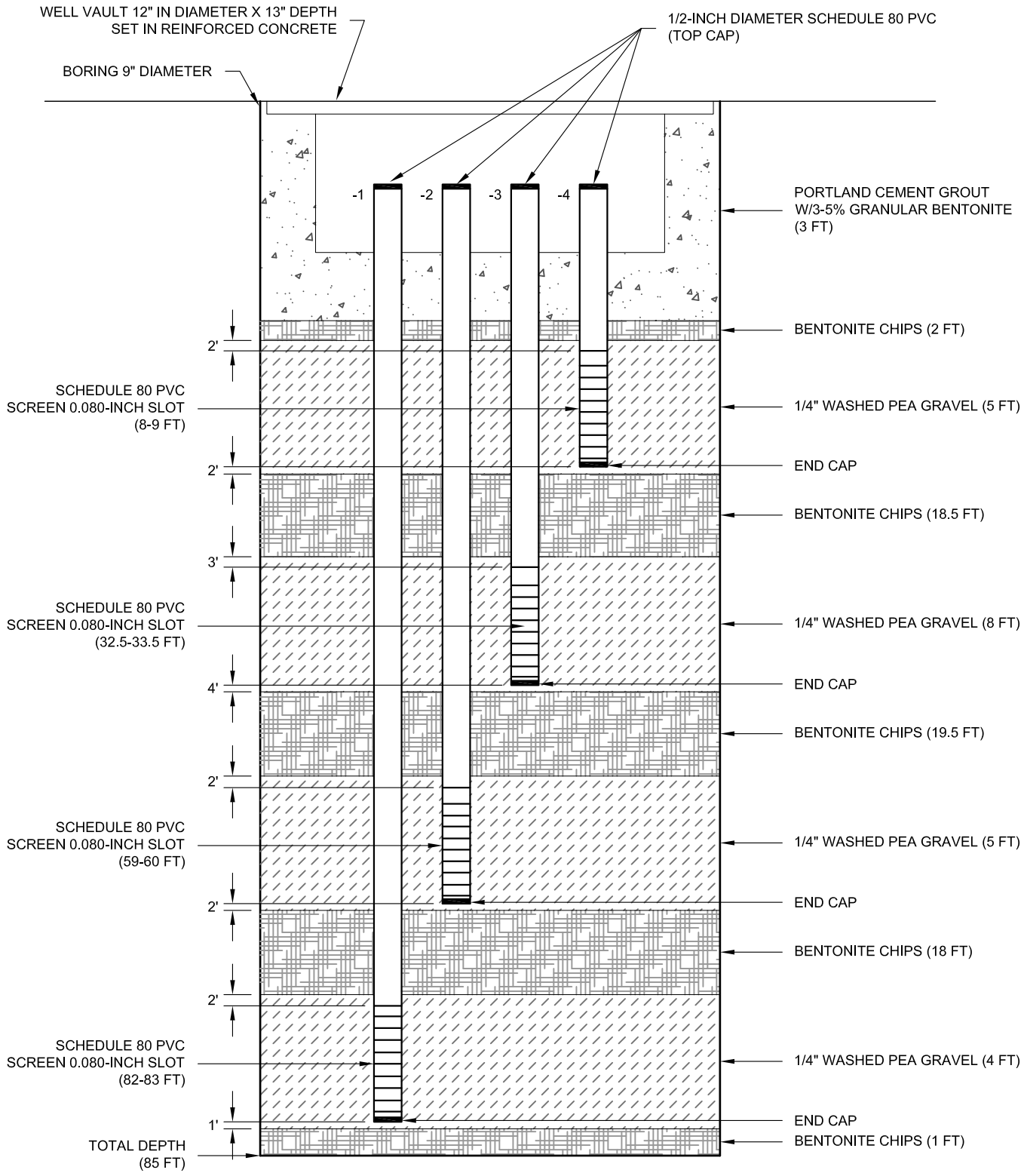
FT	- Feet
PVC	- Polyvinyl chloride
-1	- Well port notation
SVMW	- Soil Vapor Monitor Well

Well Construction of SVMW-1

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: ld	Date: 09/29/08	Project No. 10108
amec		Figure 11

Plot Date: 09/29/08 - 2:26pm, Plotted by: LineDesign
Drawing Path: N:\Geomatrix\SRP\Figures\Site Report\, Drawing Name: SRP Fig 11 SVMW-1.dwg



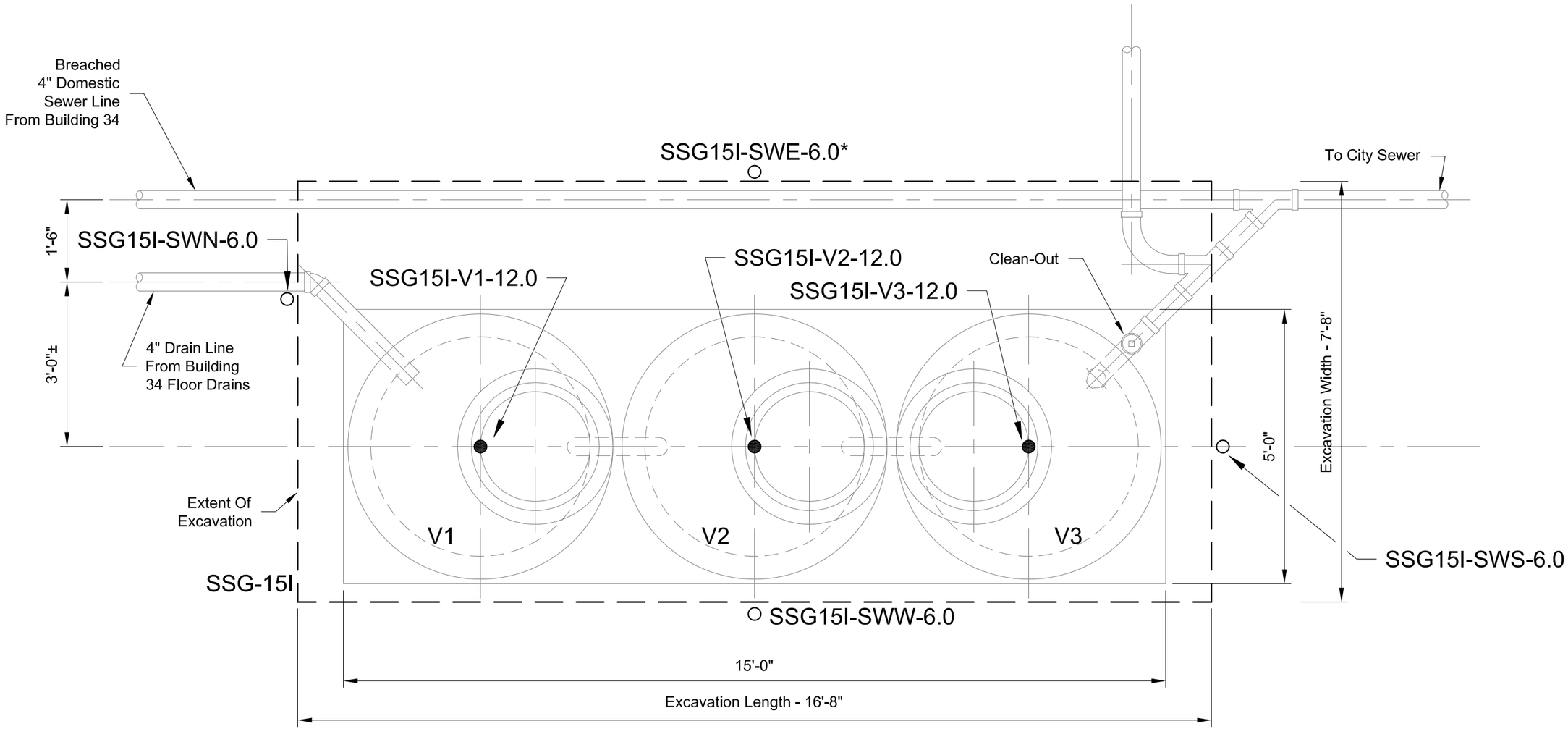
Notes:

FT	- Feet
PVC	- Polyvinyl chloride
-1	- Well port notation
SVMW	- Soil Vapor Monitor Well
%	- Percent

WELL CONSTRUCTION OF SVMW-2

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: ld	Date: 01/21/09	Project No. 10108
amec		Figure 12



N

0 1' 2'

SCALE 1/2" = 1'-0"

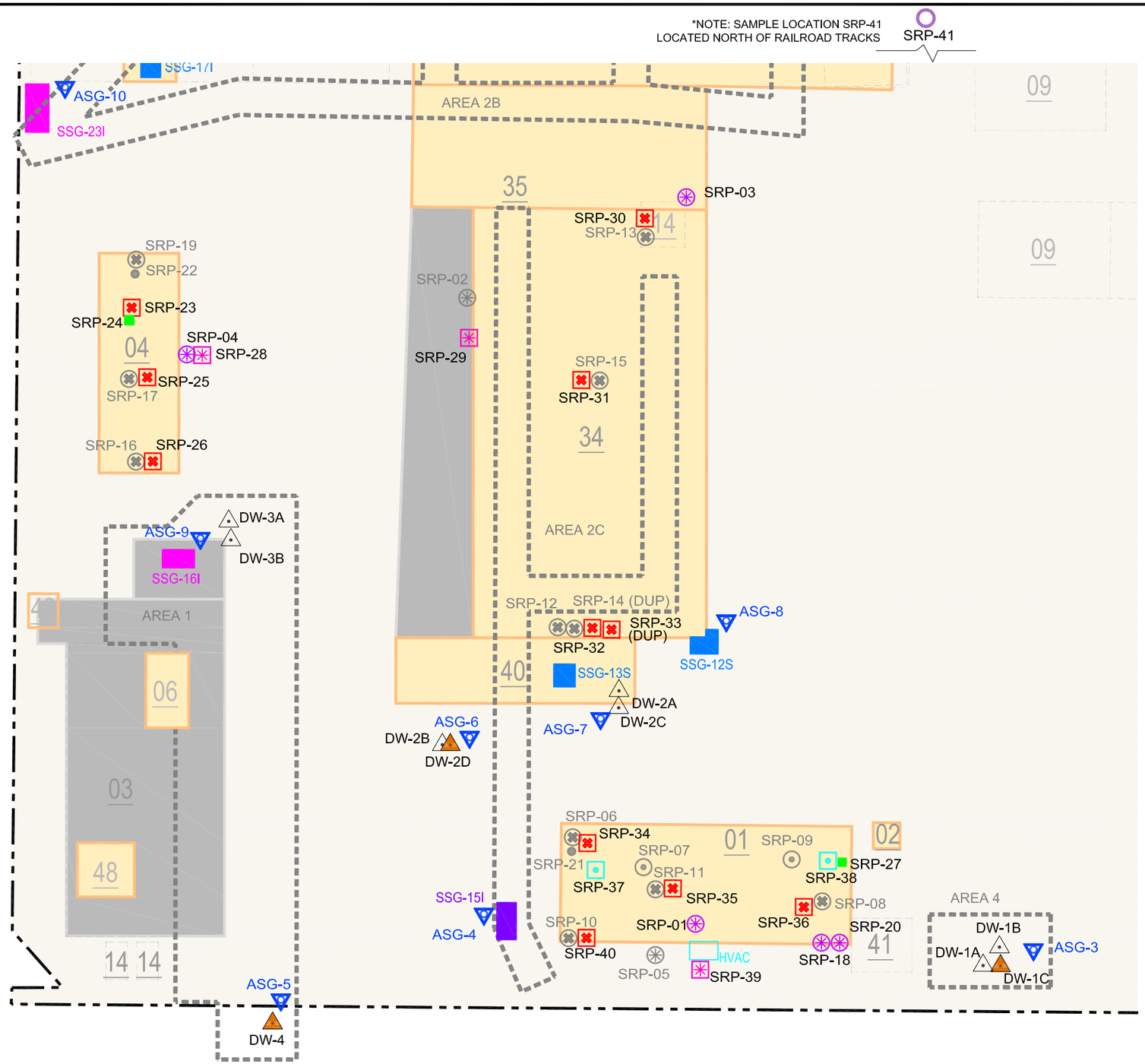
Explanations

○	Side Wall Sample Locations
●	Total Depth Sample Locations
V1	Sump Chambers
SSG-15I	Sewer Interceptor Grease Trap (sump)
*	Soil Sample Collected At Approximately 1 Foot Below Breached Sewer Line

CONFIRMATION SOIL SAMPING LOCATIONS

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: LD	Date: 01/04/2008	Project No. 10108.000
amec		Figure 13



Explanations

- Dry Well Reported
- Dry Well Confirmed
- Sewer Interceptor Grease Trap
- Sump
- Neutralizer
- Slab
- Existing Building
- Historical Building Locations
- Potential Source Area
- SSG -16th Street Garage
- ASG-1 Active Soil Gas Location
- Sump SSG-15I Removed
- SRP-06 Indoor Air Sample - March 2, 2006 (1st Floor)
- SRP-09 Indoor Air Sample - March 2, 2006 (2nd Floor)
- SRP-02 Outdoor Air Sample - March 2, 2006
- SRP-01 Outdoor Air Sample - March 2, 2006 (Roof of building)
- SRP-22 Unopened Canister - March 2, 2006 (Blank)
- SRP-06 Indoor Air Sample - Sept. 27, 2006 (1st Floor)
- SRP-09 Indoor Air Sample - Sept. 27, 2006 (2nd Floor)
- SRP-09 Outdoor Air Sample - Sept. 27, 2006
- SRP-22 Unopened Canister - Sept. 27, 2006 (Blank)
- SRP-41 Perimeter Air Sample - Sept. 27, 2006
- DUP Duplicate Sample Co-located Samples Were Located Within 1 Foot Of Each Other
- HVAC Heating, Ventilation, and Air Condintioning System

01 OFFICE BUILDING
02 GUARD HOUSE
03 ELECTRIC SHOP THROUGH 1974; PAINT/BODY SHOP
04 IRRIGATION BUILDING OFFICES (HYDROGRAPHIC WORKSHOP-1954 THROUGH MID 1970'S)
06 ICE HOUSE
09 FIRE PROOF VAULTS
14 OUT BUILDINGS
34 HEAVY EQUIPMENT GARAGE THROUGH 1986; WAREHOUSE
35 AUTO PARTS CONFERENCE ROOM THROUGH 19??; LAB AND OFFICE
40 UNLOADING AND CLEANING PLATFORM
41 SPRAY OIL SHOP
43 OIL FILTER HOUSE
48 ACROLEIN STORAGE

N

0 40 80 160 FEET

INDOOR / OUTDOOR AIR SAMPLING LOCATIONS MARCH and SEPTEMBER 2006

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: LD	Date: 01/04/2008	Project No. 10108
amec		Figure 14

Plot Date: 09/26/08 - 4:38pm, Plotted by: LineDesign
Drawing Path: N:\Geomatrix\SRP\Figures\Final RI Figures\, Drawing Name: SRP Final RI Fig 14 IAQ Sample.dwg

JACKSON ST

16ST-03

COC	June 2001	September 2007
PCE	1.0	<0.5
TCE	4.4	<0.5
1,1-DCE	6.9	<0.5
1,1,1-TCA	<0.5	<0.5

16ST-04

16ST-02

16TH ST

17TH ST

LINCOLN ST

16TH PL

16ST-01

GRANT ST

COC	June 2001	September 2007
PCE	<0.5	<0.5
TCE	<0.5	<0.5
1,1-DCE	0.5	<0.5
1,1,1-TCA	<0.5	<0.5

COC	June 2001	September 2007
PCE	<0.5	<0.5
TCE	0.5	<0.5
1,1-DCE	<0.5	<0.5
1,1,1-TCA	<0.5	<0.5

COC	June 2001	September 2007
PCE	<0.5	<0.5
TCE	<0.5	<0.5
1,1-DCE	<0.5	<0.5
1,1,1-TCA	<0.5	<0.5

Source: SRP, 2004 (Refer Section 10.0 - References)

Explanations

PCE	Tetrachloroethene, ug/L
TCE	Trichloroethene, ug/L
1,1-DCE	1,1-Dichloroethene, ug/L
1,1,1-TCA	1,1,1-Trichloroethane, ug/L
ug/L	Concentrations in Microgram per Liter
COCs	Selected Contaminants of Concern
16ST-02 ▲	Monitor Well Location
<	Less Than

N

0 45 90 180 270 360 FEET

SELECTED CONTAMINANTS OF CONCERN CONCENTRATIONS IN MONITOR WELLS

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: np	Date: 02/19/2008	Project No. 10108
amec		Figure 15

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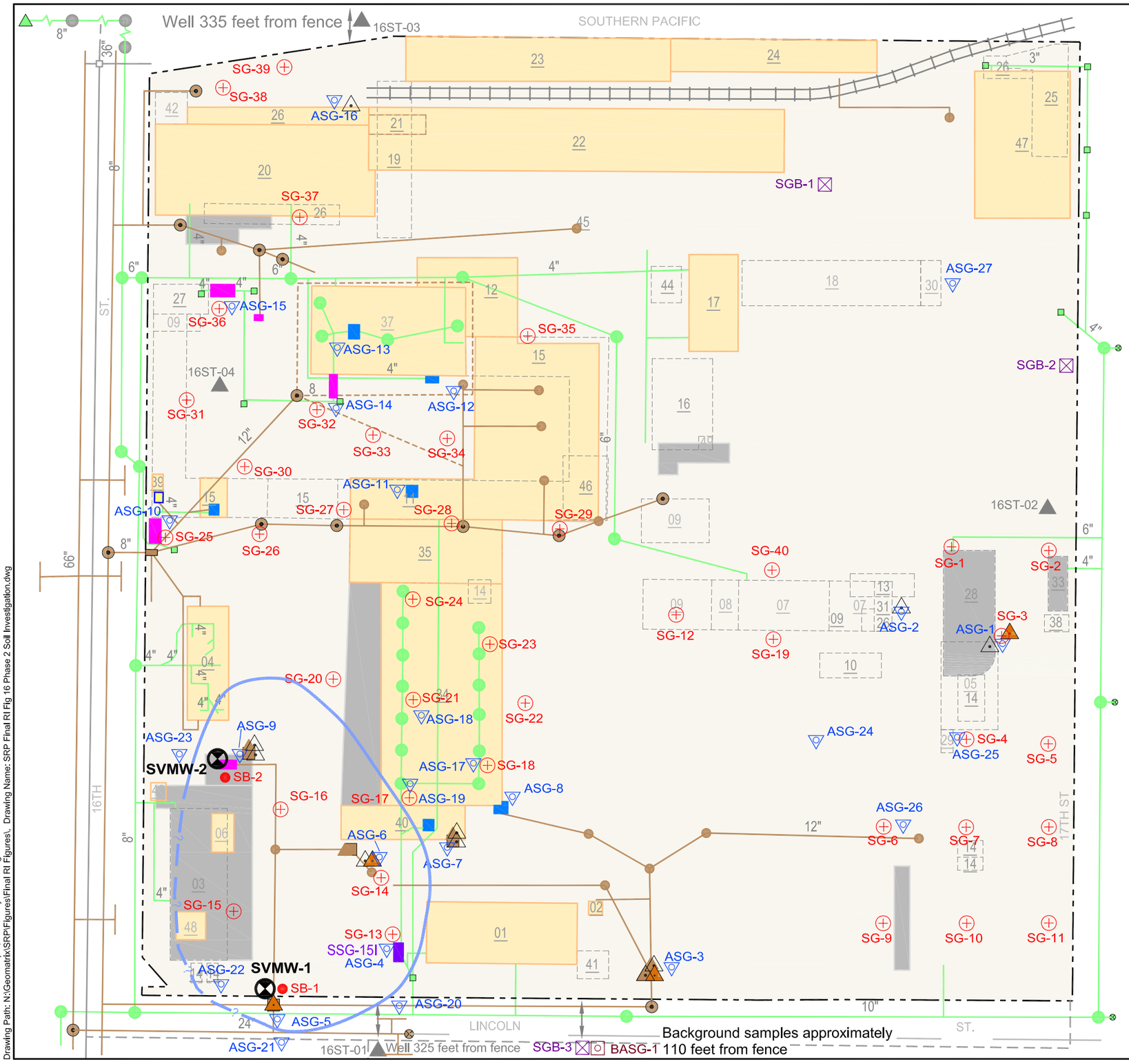

Explanations

- Dry Well Reported
- Dry Well Confirmed
- Monitor Well
- Storm Drain Cleanout
- Storm Drain Plug
- Storm Drain Gravel Well (Dry Well)
- Storm Drain Catch Well (Dry Well)
- Storm Drain Inlet
- Storm Drain Manhole
- Storm Drain Sand Trap
- Storm Drain - Open
- Storm Drain - Pipe
- Sewer Drain
- Sewer Plug
- Sewer Cleanout
- Sewer Flush Tank
- Sewer Manhole
- Sewer
- Sewer Interceptor Grease Trap
- Sump
- Neutralizer
- Slab
- Historical Building Locations

- SG-1 — Passive Soil Gas Location
- SGB-2 — Background Passive Soil Gas Location
- ASG-1 — Active Soil Gas Location
- BASG-1 — Background Active Soil Gas Location
- SVMW- — Soil Vapor Monitor Well Locations
- Sump SSG-15I Removed
- Present Building
- Not to Scale
- ? — 1µg/L based on deep soil gas analytical results (Dashed where inferred)
- µg/L — Microgram per Liter
- SB- — Phase II Soil Sampling Location

01 OFFICE BUILDING
02 GUARD HOUSE
03 ELECTRIC SHOP THROUGH 1974; PAINT/BODY SHOP
04 IRRIGATION BUILDING OFFICES (HYDROGRAPHIC WORKSHOP-1954 THROUGH MID 1970'S)
05 SALVAGE BUILDING
06 ICE HOUSE
07 METER REPAIR SHOP (1936); METER SHOP ADDITION (1954)
08 RADIO REPAIR SHOP
09 FIRE PROOF VAULTS
10 OFFICE
11 PAINT AND BODY SHOP THROUGH CIRCA 1975; STORAGE; REPAIR GARAGE THROUGH CIRCA 1986 CARPENTER SHOP THROUGH 1992; WAREHOUSE
12 AUTO PARTS STORAGE
13 SHED
14 OUT BUILDINGS
15 PARKING SHED
16 LINE MATERIAL WAREHOUSE
17 CENTRAL LINE BUILDING (OFFICES)
18 METER & ELECTRIC SHOP THROUGH 1935; ELECTRIC SHOP THROUGH 1950; LUMBER STORAGE
19 TROLLEY
20 WAREHOUSE
21 DOCK OFFICE
22 SOUTH WAREHOUSE DOCK
23 PLANER SHED (TEMP WAREHOUSE)
24 WAREHOUSE
25 CEMENT WAREHOUSE
26 WOOD PLATFORM
27 OFFICE
28 YARD SHOP
29 INCINERATOR
30 PLATFORM
31 TOOL SHED THROUGH 1952; HYDROGRAPHIC WORKSHOP
33 SALVAGE OFFICE
34 HEAVY EQUIPMENT GARAGE THROUGH 1986; WAREHOUSE
35 AUTO PARTS CONFERENCE ROOM THROUGH 19??; LAB AND OFFICE
36 WASH STALL
37 TRANSPORTATION GARAGE & MACHINE SHOP
38 RECLAMATION OFFICE
39 BATTERY BUILDING
40 UNLOADING AND CLEANING PLATFORM
41 SPRAY OIL SHOP
42 BLOCK BUILDING
43 OIL FILTER HOUSE
44 TRANSFORMER OIL TEST HOUSE
45 DOMESTIC WELL/PUMP HOUSE
46 SHED
47 WAREHOUSE
48 ACROLEIN STORAGE
49 PORTABLE OFFICE

0 35 70
APPROXIMATE SCALE IN FEET

PHASE II SOIL INVESTIGATION
SOIL BORING LOCATIONS
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: ld	Date: 01/21/09	Project No. 10108
amec		Figure 16

Plot Date: 01/21/09 - 4:06pm, Plotted by: LineDesign
Drawing Path: N:\Geomatrix\SRP\Figures\Final RI Figures\, Drawing Name: SRP Final RI Fig 16 Phase 2 Soil Investigation.dwg

Well 335 feet from fence
16ST-03
SOUTHERN PACIFIC
W1/4 COR. SEC. 10
AREA 5
DW-7 (?)
SG-39
SG-38
ASG-16 (0.025)
SGB-1
AREA 5
SG-37
SSG-24I
ASG-15 (0.044) (0.083)
SG-36
SSG-18I
ASG-13 (0.032)
SSG-14S
SG-35
SUMP A
AREA 2A
16ST-04
SSG-19I
SG-31
SG-32
ASG-14 (0.11)
ASG-12 (0.097)
SG-33
SG-34
SSG-22N
SG-30
SSG-17I
SSG-20I
ASG-11 (0.16)
ASG-10 (0.028) (0.13)
SG-27
SG-28
SSG-23I
SG-26
SG-29
SG-25
AREA 2B
SSG-21T
SG-40
SG-12
SG-19 (0.03)
SG-24
SG-23 (0.05)
(0.04) SG-20
AREA 2C
SG-21 (0.40)
SG-22 (0.05)
ASG-18 (0.059J) (0.83J)
ASG-17 (0.50J) (0.62J)
SG-18
(0.49)
ASG-8 (0.50)
SVMW-2
ASG-9 (4.30)
ASG-23 (0.52) (0.39)
SSG-16I
AREA 1
SG-16 (0.15)
(0.44) SG-17
ASG-19 (0.54J),(0.18 J)
SSG-12S
ASG-6 (2.40)
SSG-13S
DW-2A DW-2C
DW-2B DW-2D
ASG-7 (0.83)
SG-14
SG-15 (0.17)
(0.11) SG-13
ASG-4
SSG15I
ASG-22 (2.9J) (1.2J)
SVMW-1 (2.8 J) (1.40)
ASG-5 (9.70)
DW-4
ASG-20 (0.050J) (0.42J)
ASG-21 (0.21J) (0.19 J)
16TH PL
Well 325 feet from fence
16ST-01
Background samples approximately 110 feet from fence
SGB-3
BASG-1(0.17),(0.23)
ASG-2 (0.28)
DW-6
DW-5B
DW-5A
ASG-1 (<0.069) (0.42)
SG-3 (0.03)
SG-2 (0.05)
SG-1
ASG-24 (1.7) (0.97)
ASG-25 (0.65) (0.76)
SG-4 (0.07)
SG-5 (0.03)
AREA 3
ASG-26 (0.40) (0.32)
SG-6 (0.09)
SG-7
SG-8
SG-9
SG-10 (0.06)
SG-11
AREA 4
DW-1A
DW-1B
DW-1C
ASG-3 (0.41)
16ST-02
ASG-27 (0.025) (0.11)
SGB-2
ST
12" B
10"

Legend

- Dry Well Reported
- Dry Well Confirmed
- Monitor Well
- Storm Drain Cleanout
- Storm Drain Plug
- Storm Drain Gravel Well (Dry Well)
- Storm Drain Catch Well (Dry Well)
- Storm Drain Inlet
- Storm Drain Manhole
- Storm Drain Sand Trap
- Storm Drain - Open
- Storm Drain - Pipe
- Sewer Drain
- Sewer Plug
- Sewer Cleanout
- Sewer Flush Tank
- Sewer Manhole
- Sewer
- Sewer Interceptor Grease Trap
- Sump
- Neutralizer
- Slab
- Historical Building Locations
- Potential Source Area -Designated PSA

AREA 3 -Designated PSA

PCE -Tetrachloroethane

SG-1 ( ) Passive Soil Gas Location (PCE Concentration µg/L)

SGB-2 Background Passive Soil Gas Location

SVMW- Soil Vapor Monitor Well Location

? 1µg/L (1,000µg/m³) Based on Deep Soil Gas Analytical Results (Dashed where inferred)

ASG-1 (0.62) (0.62) Active Soil Gas Location Nov. 2005 (PCE Concentration µg/L) Shallow Concentration Deep Concentration

ASG-17 (0.62) (0.62) Active Soil Gas Location June 2006 (PCE Concentration µg/L) Shallow Concentration Deep Concentration

BASG-1 Background Active Soil Gas Location

µg	Micrograms
µg/L	Microgram per Liter
µg/m³	Micrograms per cubic meter
J	Flagged

100.000
66.085
43.672
28.860
19.072
12.604
8.329
5.504
3.637
2.404
1.589
1.050
0.694
0.458
0.303
0.200
0.132
0.087
0.058
0.038
0.025
PCE [µg]

0 70 140 280 FEET

N

01 OFFICE BUILDING
02 GUARD HOUSE
03 ELECTRIC SHOP THROUGH 1974; PAINT/BODY SHOP
04 IRRIGATION BUILDING OFFICES (HYDROGRAPHIC WORKSHOP-1954 THROUGH MID 1970'S)
05 SALVAGE BUILDING / SALVAGE SHED
06 ICE HOUSE
07 METER REPAIR SHOP (1936); METER SHOP ADDITION (1954)
08 RADIO REPAIR SHOP
09 FIRE PROOF VAULTS
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22 SOUTH WAREHOUSE DOCK
23 PLANER SHED (TEMP WAREHOUSE)
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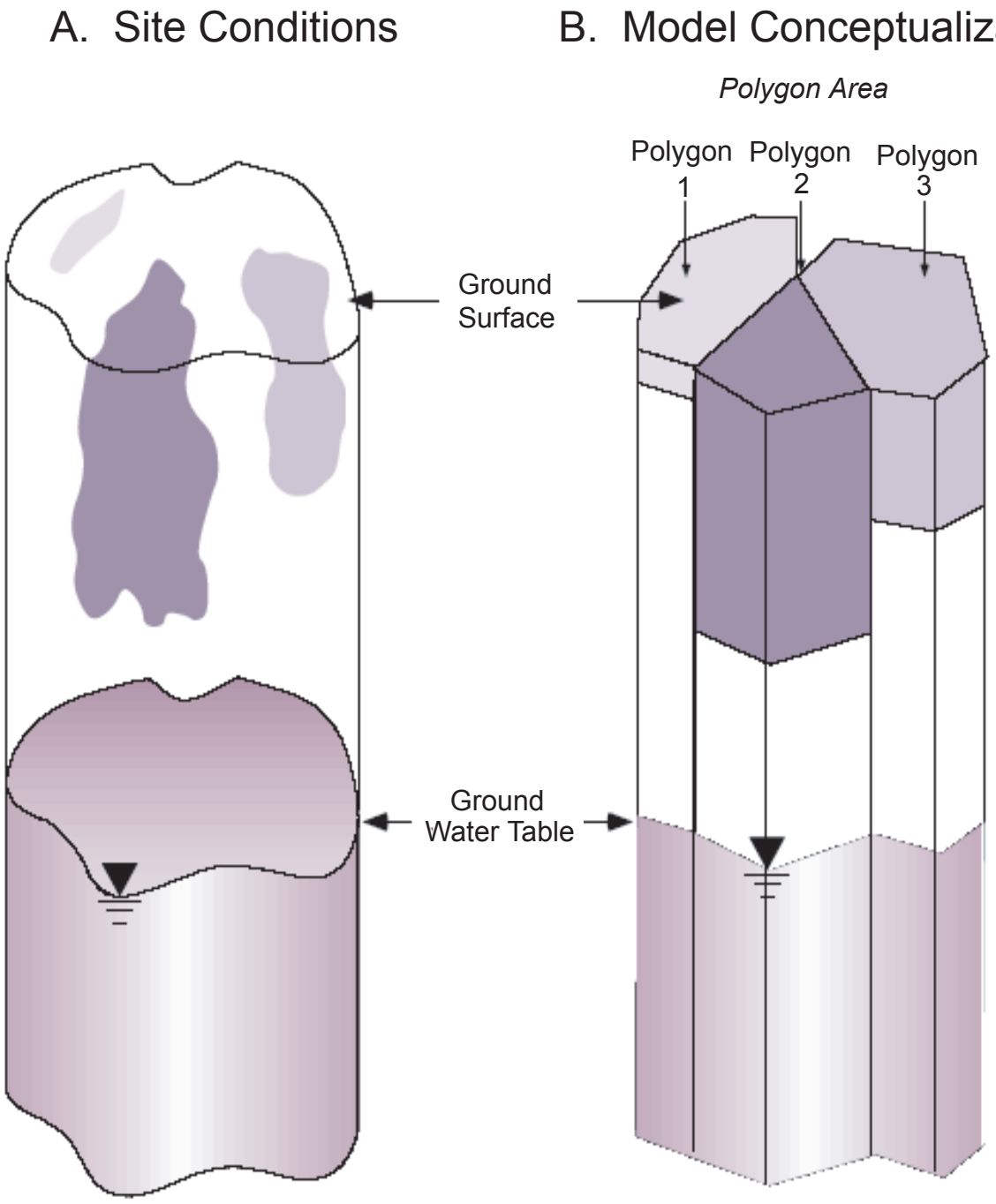
43 OIL FILTER HOUSE
44 TRANSFORMER OIL TEST HOUSE
45 DOMESTIC WELL/PUMP HOUSE
46 SHED
47 WAREHOUSE
48 ACROLEIN STORAGE
49 PORTABLE OFFICE

ACTIVE AND PASSIVE SOIL GAS SAMPLING RESULTS
Salt River Project's
16th Street Facility
Phoenix, Arizona

By: LD	Date: 04/16/2008	Project No. 10108.000
amec		Figure 17

Plot Date: 01/21/09 - 4:58pm, Plotted by: LineDesign
Drawing Path: N:\Geomatrix\SRP\Figures\Final RI Figures\, Drawing Name: SRP Final RI Fig 17 PhII Active-Passive SG.dwg

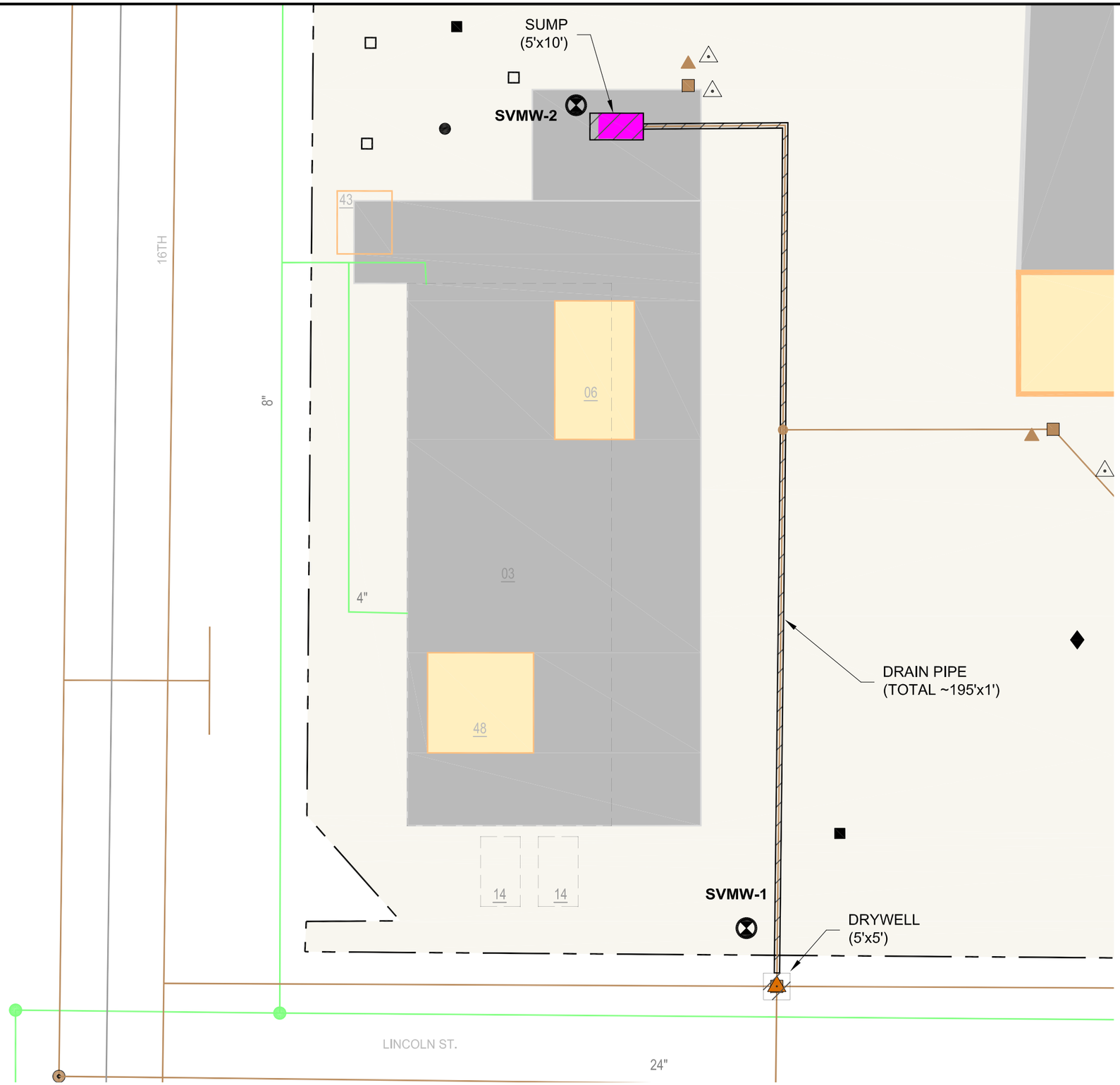


Source: Ravi, V. and Johnson, J.A., 1997. VLEACH, A One-Dimensional Finite Difference Vadose Zone Leaching Model Version 2.2

CONCEPTUAL REPRESENTATION OF TWO-DIMENSIONAL POLYGON
Salt River Project's16th Street Facility
Phoenix, Arizona

Project No. 10108
Figure **18**

I:\Project\10108_SRP_OU3_Activities\SVMW Sampling\Tech_memo_SRP_Tech_Memo_Figure_3



Explanations

- Dry Well Reported
- Dry Well Confirmed
- Storm Drain Cleanout
- Storm Drain Plug
- Storm Drain Gravel Well (Dry Well)
- Storm Drain Catch Well (Dry Well)
- Storm Drain Inlet
- Storm Drain Manhole
- Storm Drain - Open
- Storm Drain - Pipe
- Sewer Drain
- Sewer Cleanout
- Sewer Flush Tank
- Sewer Manhole
- Sewer
- Sewer Interceptor Grease Trap
- Slab
- Soil Vapor Monitor Well Locations
- SVMW-
- Present Building
- Not to Scale
- Modeled Potential Source Area
- UST Soil Sampling, 1987-1990 (no COCs data)
- Soil Boring Investigation, 1989
- Soil Sample Location (Drywell Investigation, 1990)
- Soil Sample Location (Fireline Trench Investigation, 1990)
- Monitor Well (Groundwater Investigation, 2001)
- Soil Gas Survey, 2002
- UST Underground Storage Tank
- COCs Contaminants of Concern

03 ELECTRIC SHOP THROUGH 1974; PAINT/BODY SHOP
06 ICE HOUSE
14 OUT BUILDINGS
43 OIL FILTER HOUSE
48 ACROLEIN STORAGE

N

0 10 20 FEET

MODELED POTENTIAL SOURCE AREAS

Salt River Project's
16th Street Facility
Phoenix, Arizona

By: LD	Date: 01/26/2008	Project No. 10108
amec		Figure 19